TECHNICAL REPORT BCEPD 05-

SEA TURTLE CONSERVATION PROGRAM BROWARD COUNTY, FLORIDA 2005 REPORT

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For the:

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS
ENVIRONMENTAL PROTECTION DEPARTMENT
BIOLOGICAL RESOURCES DIVISION

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INTRODUCTION

Since 1978, the Broward County Environmental Protection Department (BCEPD) has provided for the conservation of endangered and threatened sea turtle species within its area of responsibility. Broward County is within the normal nesting areas of three species of sea turtles: the loggerhead sea turtle (*Caretta caretta*), the green sea turtle (C*helonia mydas*) and the leatherback sea turtle (*Dermochelys coriacea*). The loggerhead is listed as a threatened species, while the green and leatherback are listed as endangered under the U.S. Endangered Species Act, 1973, and Chapter 370, F.S.

Since these statutes strictly forbid any disturbance of sea turtles and their nests, conservation activities involving the relocation of nests from hazardous locations (especially necessary along heavily developed coasts) require permitting by the U.S. Fish and Wildlife Service (USFWS). In Florida, this permit is issued to the Florida Fish and Wildlife Conservation Commission (FWCC), Bureau of Protected Species Management, Tallahassee, Florida. This project was administered by the BCEPD and conducted by the Nova Southeastern University Oceanographic Center under Marine Turtle Permit #108, issued to the BCEPD by the FWCC.

The BCEPD is especially concerned with any environmental effects of intermittent beach nourishment projects on shorelines and the offshore reefs. As part of this concern, the BCEPD has maintained the sea turtle conservation program in non-nourishment years to provide a continuous database and for monitoring of completed nourishment projects. Nova

Southeastern University was awarded the contract to conduct the 2005 program.

In addition to fulfilling statutory requirements, the purposes of the project were:

1) to relocate eggs from nests deposited in sites threatened by natural processes or human activities and thus maximize hatchling survival,

2) to accurately survey sea turtle nesting patterns to document historical trends and assess natural and anthropogenic factors affecting nesting patterns and densities,

3) to assess the success of sea turtle recruitment and of hatchery operations in terms of nesting success, hatching success and total hatchlings released,

4) to dispose of turtle carcasses, respond to strandings and other emergencies and maintain a 24-hour emergency cell phone for reporting of turtle incidents, and

5) to inform and educate the public about sea turtles and their conservation.

MATERIALS AND METHODS

Beach Survey

Daily beach surveys commenced one half hour before sunrise. For survey purposes the County was divided as follows:

BEACH	BEACH LENGTH (km)	BOUNDARIES	DEP SURVEY MARKER #
Hillsboro-Deerfield Beach	7.0	Palm Beach Co. line to Hillsboro Inlet	R1-24
Pompano Beach	7.7	Hillsboro Inlet to Commercial Blvd.	R25-50
Fort Lauderdale	10.6	Commercial Blvd. to Port Everglades Inlet	R51-85
John U. Lloyd Park	3.9	Port Everglades Inlet to Dania Beach fence	R86-97
Hollywood-Hallandale	9.4	Dania Beach fence to Miami Dade Co. line	R98-128

The location of Broward County and the positions of the boundary lines above are shown in Figure 1 A-F.

Daily surveys of Hillsboro-Deerfield, Pompano, Fort Lauderdale and Hollywood-Hallandale beaches commenced on March 1, 2005. Surveys continued through September 30th. The beach at John U. Lloyd State Park was patrolled by park personnel who provided the data from that area. Except in Lloyd Park, nest locations were referenced to FDEP beach survey monuments numbered consecutively from R1 to R128 (N to S). Marker numbers corresponding to each beach area are listed above. Each nest location was initially recorded relative to the nearest building,

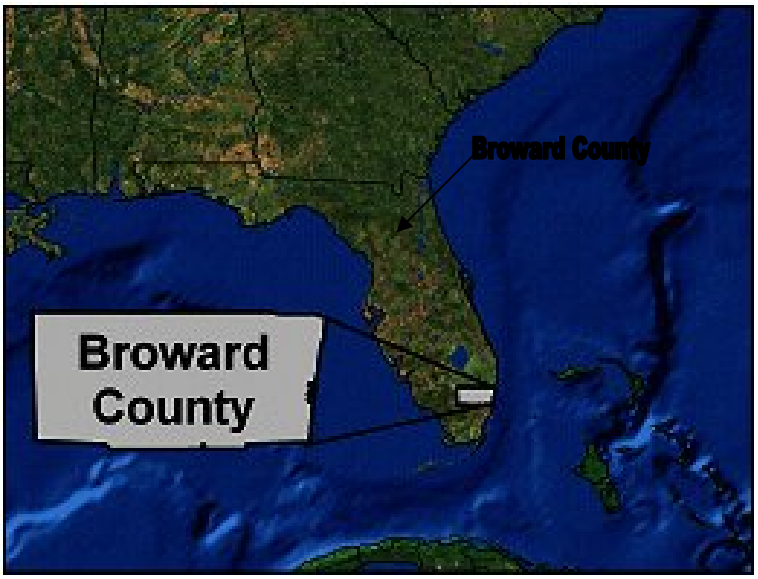


Figure 1A: The location of Broward County, FL

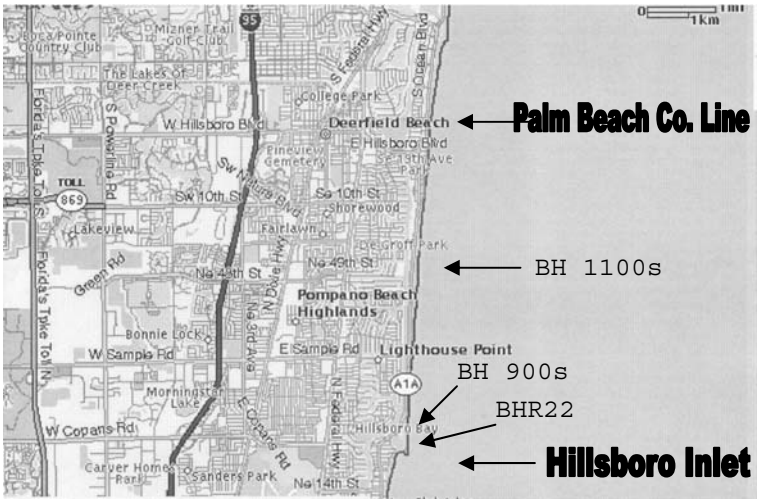


Figure 1B: Northern Broward County.

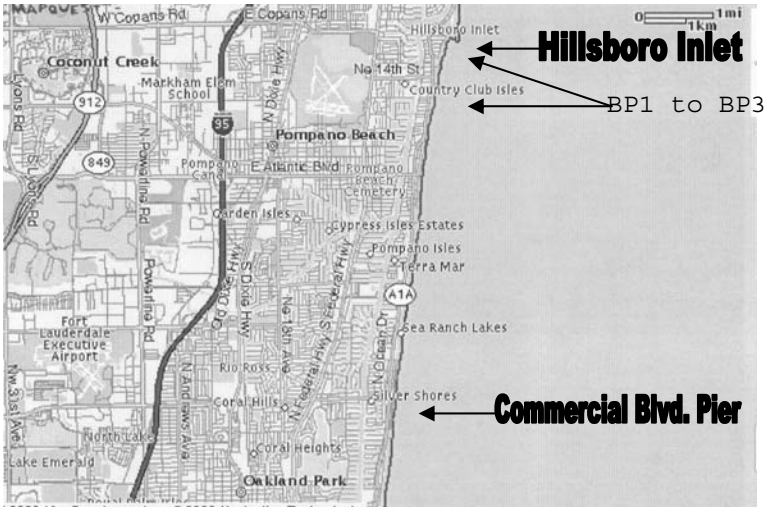


Figure 1C: North Central Broward County.

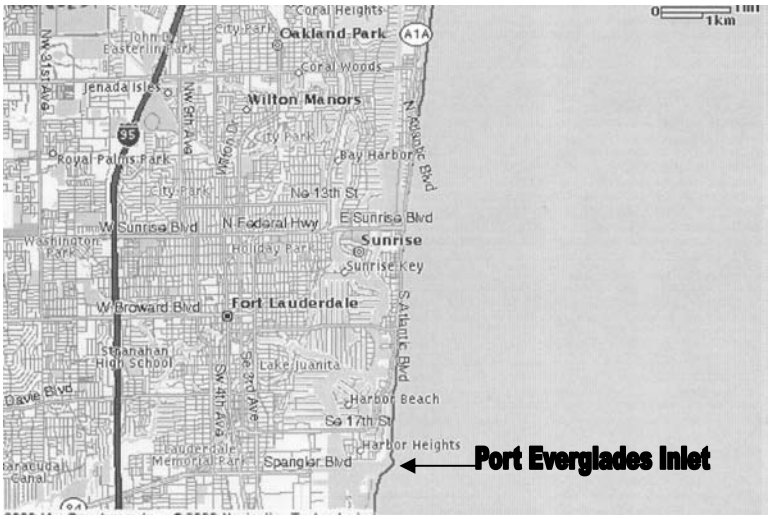


Figure 1D: Central Broward County

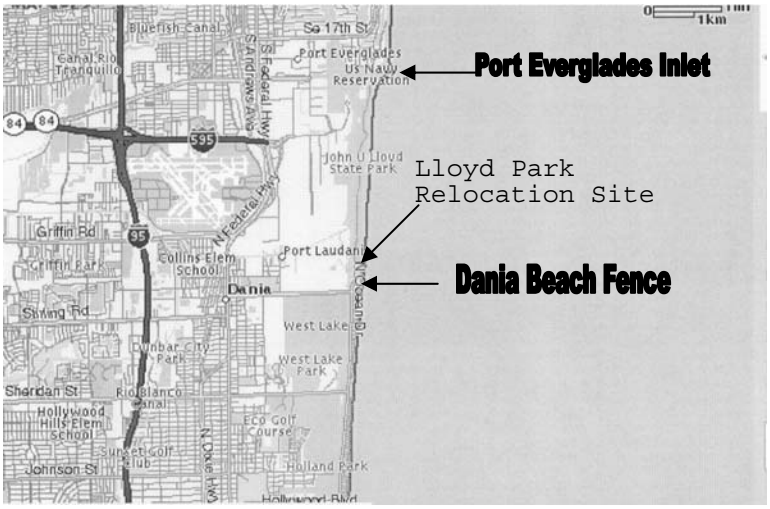


Figure 1E: South Central Broward County, showing the open beach hatchery in Lloyd Park.

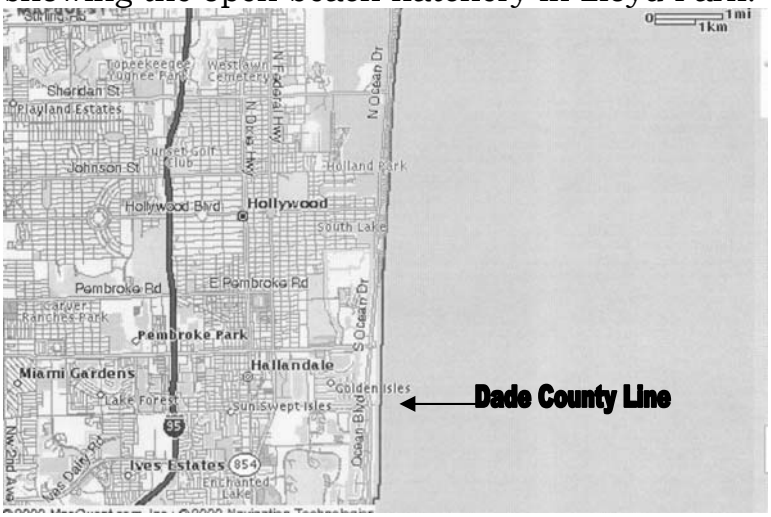


Figure 1F: Southern Broward County

street, or other landmark. These locations were later cross-referenced to the nearest survey marker. Nest and non-nesting (false) crawl locations were also recorded using Global Positioning System (GPS) receivers. All false crawls were recorded, but those that did not reach the previous high tide line were listed separately.

In John Lloyd Park, four 1-km zones (zone 1 farthest north) were used for recording nest locations due to the relative lack of beach landmarks. This was also done to provide continuity with the data collected in Lloyd Park during previous years.

Surveyors used four-wheeled all-terrain vehicles (ATVs) that carried up to six turtle nests per trip in plastic buckets. The usual method was to mark and record nests and false crawls on the first pass along the beach and then dig and transport nests in danger of negative impacts on the return pass. Due to early beach cleaning in Fort Lauderdale, two workers picked up the nests on the first pass. Nests were transferred to a third person who transported them to their destination by car. Early in the season, nests were often transported directly on the ATVs to fenced beach hatcheries. After recording all pertinent information, the crawl marks were obliterated to avoid duplication.

Nests in danger of negative impacts were defined as follows:

1) a nest located within 10 feet of the previous evening wrack line,
2) a nest located near a highway or artificially lighted area defined as a beach area where a surveyor can see his shadow on a clear night, and
3) a nest located in an area subject to beach nourishment.

Especially due to definition 2, most of the nests discovered at Pompano Beach, Deerfield Beach, and Fort Lauderdale beaches were considered to be in danger of negative impact and therefore were relocated to fenced beach hatcheries or to unfenced beach locations. Due to an

ongoing beach nourishment project, all nests found on Hollywood-Hallandale Beach were relocated to a fenced hatchery or the open beach in John Lloyd Park. Nests in danger of negative impacts at Hillsboro Beach were individually relocated to safer nearby locations (designated BH) or they were moved to open beach locations adjacent to homes with house numbers in the 900s through the 1200s on Highway A1A. These locations were designated BH900s, BH1000s, BH1100s and BH1200s, respectively. The locations of the most southerly and northerly limits of this area (BH900s and BH1200s, respectively) are shown in Figure 1B. Some Hillsboro nests were also moved to a location designated BHR22-24, near survey marker R22 through R24, just north of the Hillsboro Inlet.

All green turtle nests were left *in-situ* except for those laid less than 10 feet from the high tide line and those deposited on Hollywood-Hallandale Beach, which was being nourished. Only 11 green turtle nests were relocated (4 of these in beach nourishment area) while 171 were left in place.

Early nests from Pompano Beach and Fort Lauderdale were relocated to restraining hatcheries. After mid May when the restraining hatcheries were filled, nests were relocated to three open beach locations in Pompano Beach. These were designated BP1, BP2 and BP3, near survey markers R26, R29 and R31, respectively. The northerly (BP1) and southerly (BP3) limits of this area are shown in Figure 1C. The nests were located with 4 feet between the centers of the egg chambers and marked with stakes and signs (Appendix 4). BP1 was marked with stakes and caution tape. BP2 and BP3 were designated using PVC pipe and plastic chain, which held up better than stakes and tape. The locations, layout,

nest numbers and dates of each nest relocated to these sites are provided in Appendix 3.

Because the size of the restraining hatchery in Hollywood was greatly reduced due to erosion, Hollywood nests were also relocated to an open beach site just north of the Dania Beach fence in John Lloyd State Park (Figure 1E). These nests were protected with self-releasing flat screens, but the success of the screens in preventing raccoon predation was limited.

Nests to be relocated were carefully dug by hand, and transported in buckets containing sand from the natural nest chamber. The depths of the natural egg chambers were measured and recorded. The eggs were then transferred to hand-dug artificial egg chambers of similar dimensions, which were lined with sand from the natural nest. Care was taken to maintain the natural orientation of each egg, to minimize possible injury to the embryos.

A total of 675 nests were not in danger of negative impacts and were marked with stakes bearing yellow 5.5" X 8.8" sea turtle nest warning signs (Appendix 4) and left *in situ*. After hatching, 267 of these nests (40 percent) were excavated for post emergence examination. The number of hatchlings released from each nest was determined as the total number of eggs minus the number of hatchlings found dead in the nest (DIN), dead pipped eggs with partially emerged hatchlings (DPIP), and unhatched eggs showing visible (VD) or no visible development (NVD). The number of hatchlings alive in the nest (LIN) and live pipped eggs (LPIP) were included in the number of hatchlings released but were subtracted from this number to determine the number which naturally

emerged from each nest. Hatchling release success was defined as the number of released hatchlings divided by the total number of eggs.

Restraining Hatcheries

As in previous years, chain-link fenced hatcheries were located in Pompano Beach near Atlantic Boulevard, at the South Beach municipal parking lot in Fort Lauderdale, and at North Beach Park in Hollywood. Prior to the nesting season, the sand in the hatcheries was dug out to a depth of three feet and replaced with sand from elsewhere on the beach. Early season nests were relocated to the restraining hatcheries but they were not reused after the first round of nests hatched.

Hatchery nests showing a depression over the egg chamber were covered with a bottomless plastic bucket to retain hatchlings, although the turtles sometimes escaped these enclosures by digging around them. After hatching commenced, the hatcheries were checked three times each night between 9:00 and 11:00 PM, midnight and 2:00 AM and again between 3:00 and 5:00 AM. Hatchlings found in the evening were released that same night in dark sections of Pompano Beach, Fort Lauderdale, Hillsboro Beach, Hollywood or Lloyd Park, by allowing them to crawl through the intertidal zone into the surf. Hatchlings discovered in the morning in the hatcheries were collected and held indoors in dry plastic buckets in a cool, dark place until that night, when they were released as above. After hatching, all hatchery nests were dug up, and counts of spent shells, live hatchlings, dead hatchlings, live and dead pipped eggs and eggs with arrested or no visible development were made.

Data analysis

The data were compiled, analyzed and plotted primarily with Quattro Pro, version 8 (Corel Corp. Ltd.) and Statistica, release 6

(StatSoft, Inc.). The countywide yearly nesting densities from 1981 to 2005 for the three species were plotted and trends were assessed by linear regression and correlation analyses. Seasonal nesting patterns and nesting densities were calculated for each beach (nests per km) and the beaches were compared using 1-way analysis of variance (ANOVA) and Newman-Keuls (NK) tests at the 0.05 significance level. The total number of nests deposited by each species in the beach segments corresponding to each FDEP survey marker was tabulated and plotted. GPS positions for most nests and false crawls were also plotted on the Broward County Coastline Aerial Shore Line Map using the ArcView Geographic Information System (GIS).

Total nesting success (nests/total crawls) for each species at each beach was computed and the mean daily nesting success of loggerheads and greens at each beach was compared by ANOVA and NK analyses. The average nesting success in each zone was also plotted versus its FDEP survey number. The numbers of eggs and live hatchlings of each species in relocated and evaluated *in situ* nests were recorded and the hatching successes were determined. The overall hatching successes of all eggs from relocated and *in situ* nests were plotted from 1981 through 2005. The frequency distribution of the hatching success of *in situ* and relocated loggerhead nests were plotted and compared with the Mann-Whitney U-test. The mean hatching percentages and proportions of the post-hatching egg categories (LIN, LPIP, DIN, DPIP, VD and NVD) were tabulated by species from nests deposited or relocated at each of the individual beaches or relocation sites.

RESULTS

Figure 2 shows the historical trend in the total number of sea turtle nests deposited in Broward County since 1981. A total of 2055 nests were found in 2005, which was up 3.8 percent from 2004 but it was still significantly (P = .0001) below the previous 10-year mean of 2525.

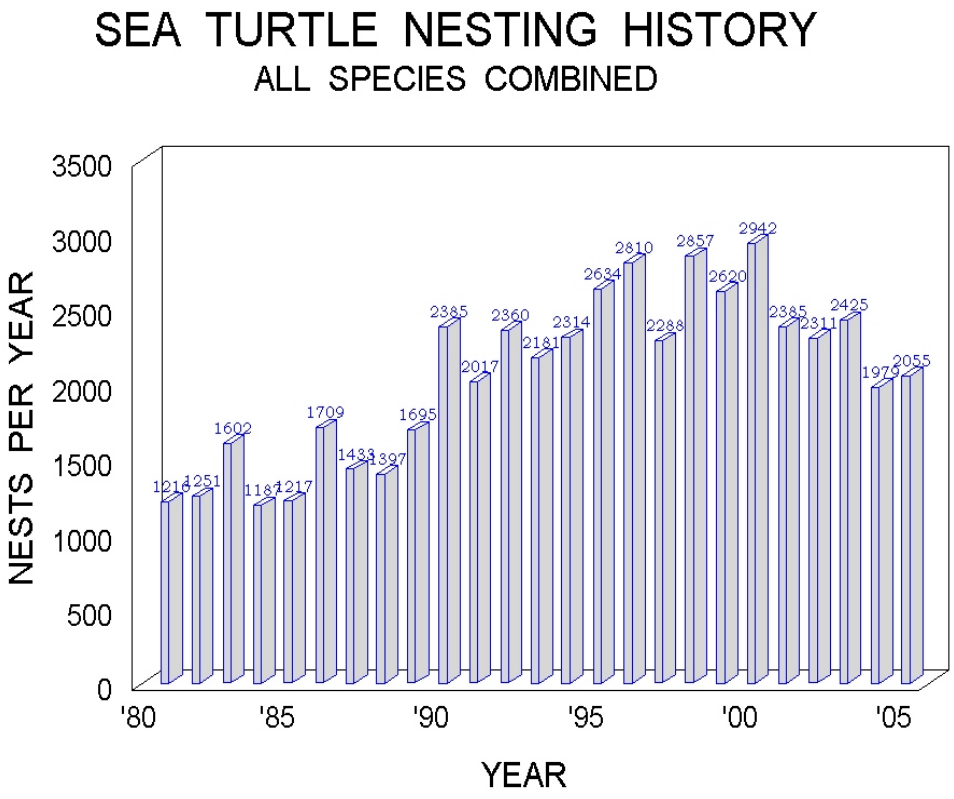


Figure 2: The pattern of total sea turtle nesting in Broward County since full surveys commenced in 1981.

Except for last year, this was the lowest nest count since 1991.

Figure 3 shows the yearly nesting trends of loggerhead, green and leatherback sea turtles. Loggerheads deposited 1819 nests in 2005 which was the lowest number since 1989, but essentially unchanged from last year's count of 1822. While the overall loggerhead nesting trend remains positive, the trend since 1995 is negative (P = .005) and indicates an

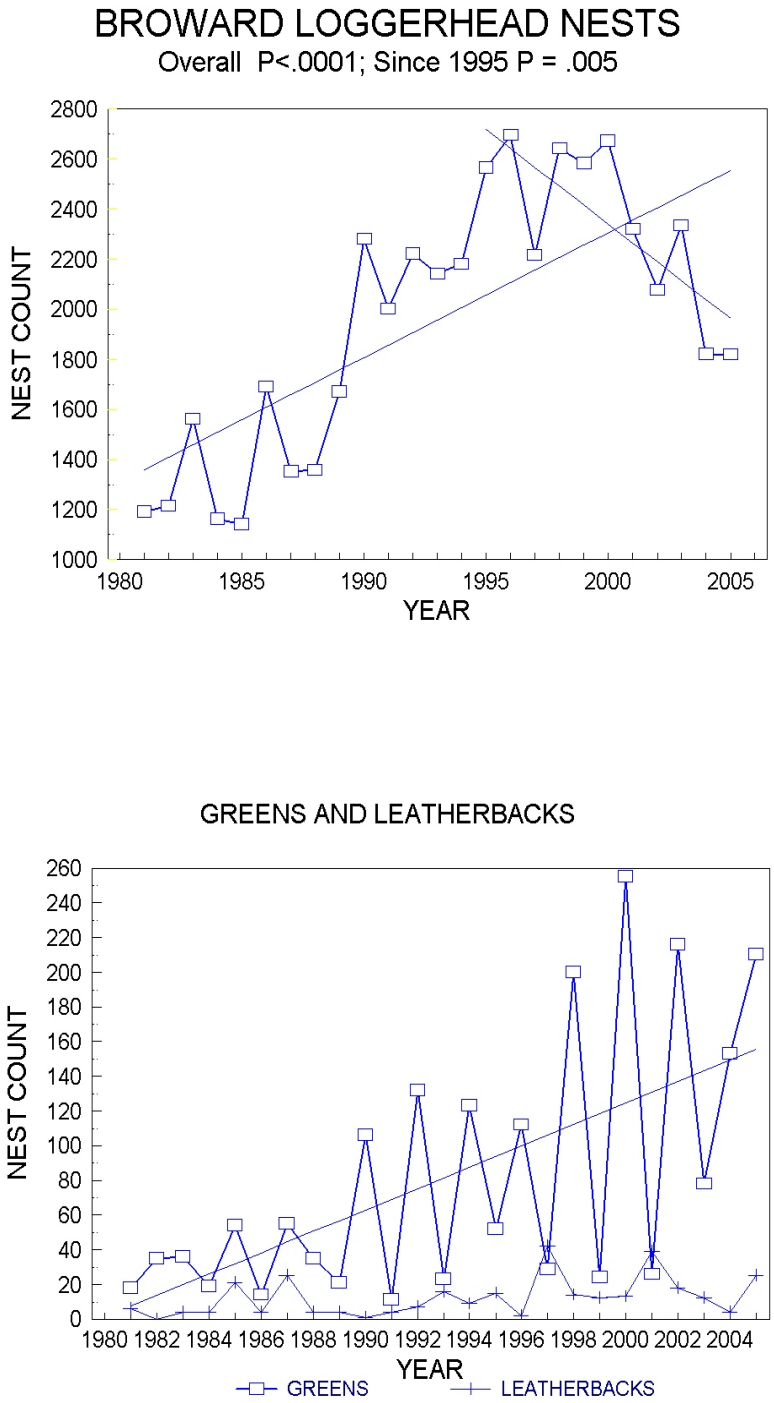


Figure 3: Historical nesting patterns of loggerhead, green and leatherback sea turtles in Broward County since 1981.

average decline of 75 nests per year. This year's loggerhead nest count was 574 (2 standard deviations) below the previous 10-year average.

Green turtle nesting in 2005 appears to have broken the alternating high-low pattern extending at least back to 1989 (Fig. 3). This year should have been a low nesting year but the nest count was the third highest on record. Despite the large fluctuations, the slope of the 25-year trend line for green turtle is significantly greater than zero (P = .0011), suggesting an average increase of 6.2 nests per year. Leatherbacks deposited 25 nests in 2005, which tied the third highest recorded yearly count. The overall nesting trend is positive (P =.034) suggesting an average increase of 0.64 nests per year since 1981 but the trend is tenuous. This year, there was one incidental hawksbill (*Eretmochelys imbricata*) nest deposited in Fort Lauderdale. The species was confirmed on post hatching evaluation.

Figure 4 shows the seasonal loggerhead nesting pattern. The first and last nests were deposited on 27 April in Hillsboro Beach and on 24 August in Pompano Beach. Table 1 and Figure 5 give the total loggerhead nesting densities and seasonal patterns for the five beaches. Nesting densities (mean daily nests/km) was again highest in Hillsboro Beach, followed by Pompano Beach, Fort Lauderdale, Lloyd Park and Hollywood. The rank order has not changed since 2003. Nesting on Pompano Beach was not statistically different from Hillsboro Beach or Fort Lauderdale, but Lloyd Park and Hollywood were statistically distinct.

The countywide seasonal nesting patterns of greens and leatherbacks are shown in Figure 6 and for the individual beaches in

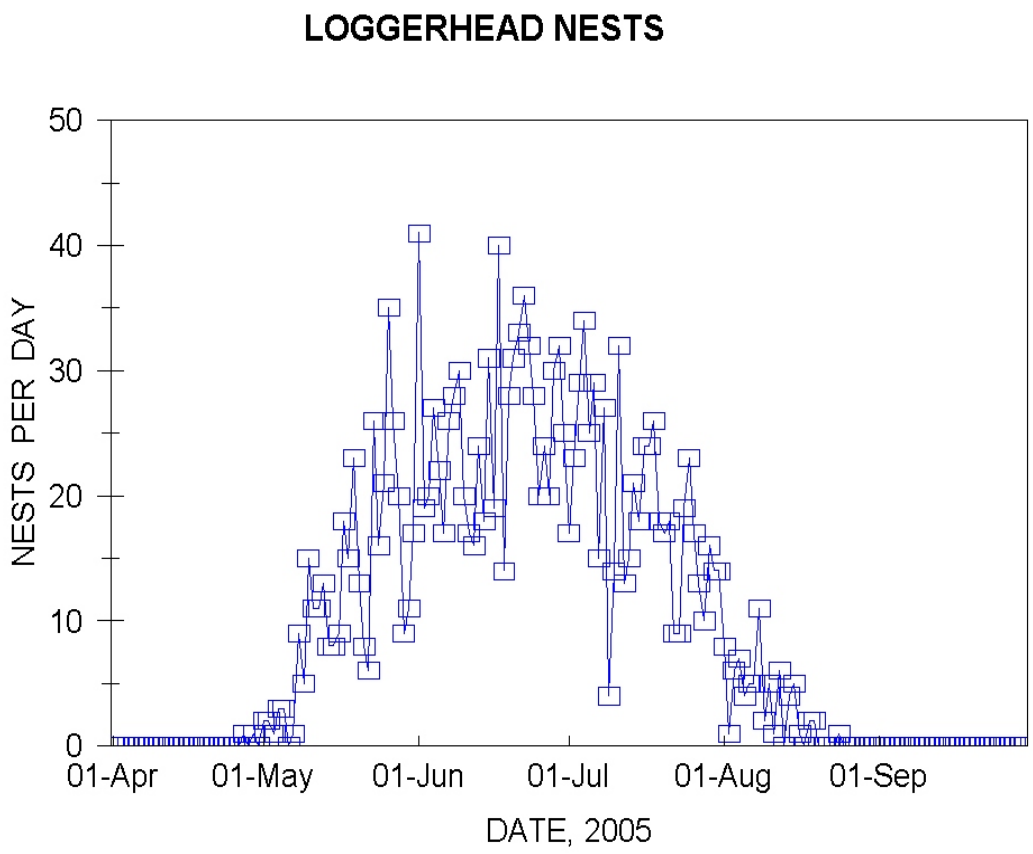


Figure 4: The seasonal pattern of daily loggerhead nesting in Broward County, 2005.

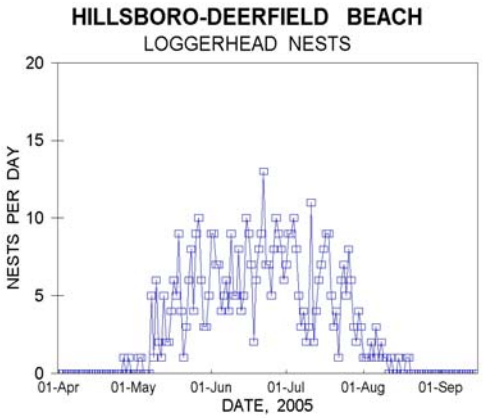
Table 1: Total loggerhead nests and nesting densities expressed as nests-per-kilometer for the 2005 season. Beaches with the same NK designation letters were not significantly different in a Newman-Keuls test (α = .05) of mean daily nesting per km (1 Apr-15 Sep). Beaches with different NK letters had significantly different nesting densities.

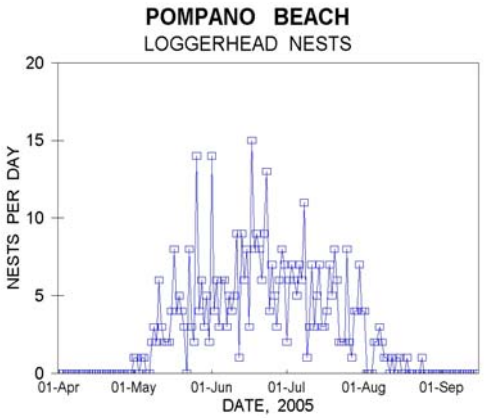
BEACH	TOTAL NESTS	BEACH LENGTH (km)	Nests per km	MEAN DAILY NESTS per km with NK Designation Letter
Hillsboro Beach	526	7.0	75.1	.439 A
Pompano Beach	474	7.7	61.6	.363 AB
Ft. Lauderdale	580	10.6	54.7	.324 B
Lloyd Park	138	3.9	35.4	.211 C
Hollywood	101	9.4	10.7	.062 D
OVERALL	1819	38.6	47.1	

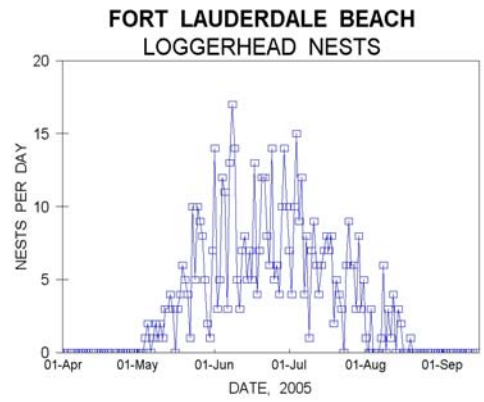
Figure 7. The first and last leatherback nests were deposited on 25 March and 28 May, in Hillsboro Beach. The Green turtles nested between 5 June and 10 September in Hillsboro Beach. Nesting densities for greens and leatherbacks are shown in Table 2 and Table 3, respectively. Nesting by greens was significantly higher in Hillsboro Beach followed by Lloyd Park. Nesting densities in Fort Lauderdale, Pompano Beach and Hollywood were lower and not statistically different.

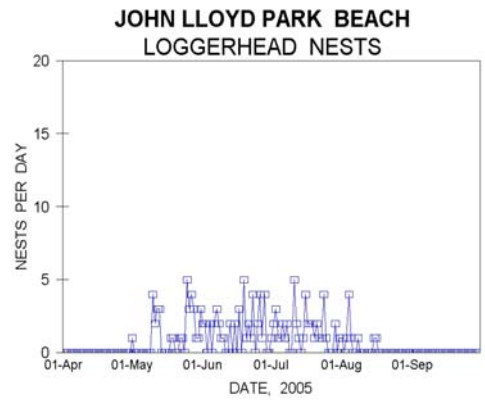
Figure 8 shows nest counts for each species in each 1000-foot zone of Broward County beach (1-km zones in Lloyd Park) during 2005. As in previous years, the low nesting zones R2, R24, R34 and R50 were near the Deerfield Beach Pier, the Hillsboro Inlet, the Pompano Beach Pier and the Commercial Boulevard pier, respectively. The beach along the Fort Lauderdale strip (R61 to R78) and the entire beach south of R98 were also lightly nested. Loggerheads nested most frequently in zone R21 in the residential section of Hillsboro Beach. This has been the most heavily nested zone since 2002. This year's nest distribution was remarkably similar to last years pattern except for R-47, which received 46 loggerhead nests in 2005 compared to 23 in 2004.

Figure 9 and Table 4 present the countywide distribution of nesting success for the three species. Loggerhead nesting success showed no countywide trends. Except in Hollywood, nesting success was less than 20 percent only in zone R76, just north of the Fort Lauderdale strip. Nesting successes of 20 and 22 percent occurred respectively in zones R-34 near the Pompano Beach Pier and R-25 just south of the Hillsboro Inlet. These locations have had low nesting success in previous years (Burney and Ouellette, 2003). There were several zones with low or zero









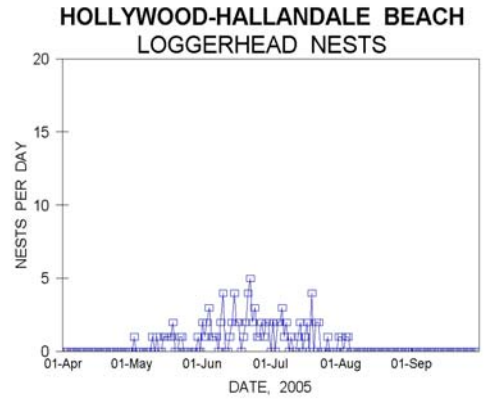


Figure 5: Comparison of the daily loggerhead nesting patterns on the five Broward County beaches in 2005.

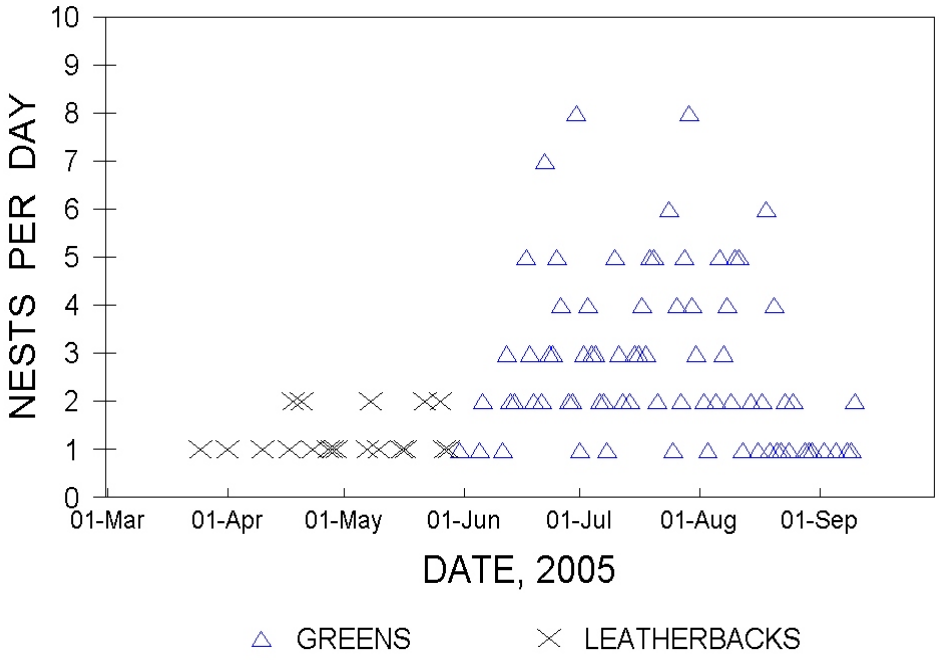


Figure 6: The seasonal pattern of daily green and leatherback nesting in Broward County, 2005.

nesting success in Hollywood but there was very little nesting in that area. Loggerhead nesting success was highest in Hillsboro Beach and lowest in Lloyd Park. Mean nesting successes in Hillsboro Beach, Pompano Beach and Hollywood were not statistically different. Although second highest, mean nesting success in Fort Lauderdale was not statistically different from Hillsboro Beach or Lloyd Park because of high variability. Despite ongoing beach nourishment, nesting success on Hollywood beach was 40.9 percent compared to 28.5 percent in 2004. One-way ANOVA showed no significant differences in the nesting success of greens or leatherbacks throughout the County (Table 4).

Table 5 gives the number of nests for each species that were relocated to Hillsboro Beach or to fenced hatcheries, as well as the

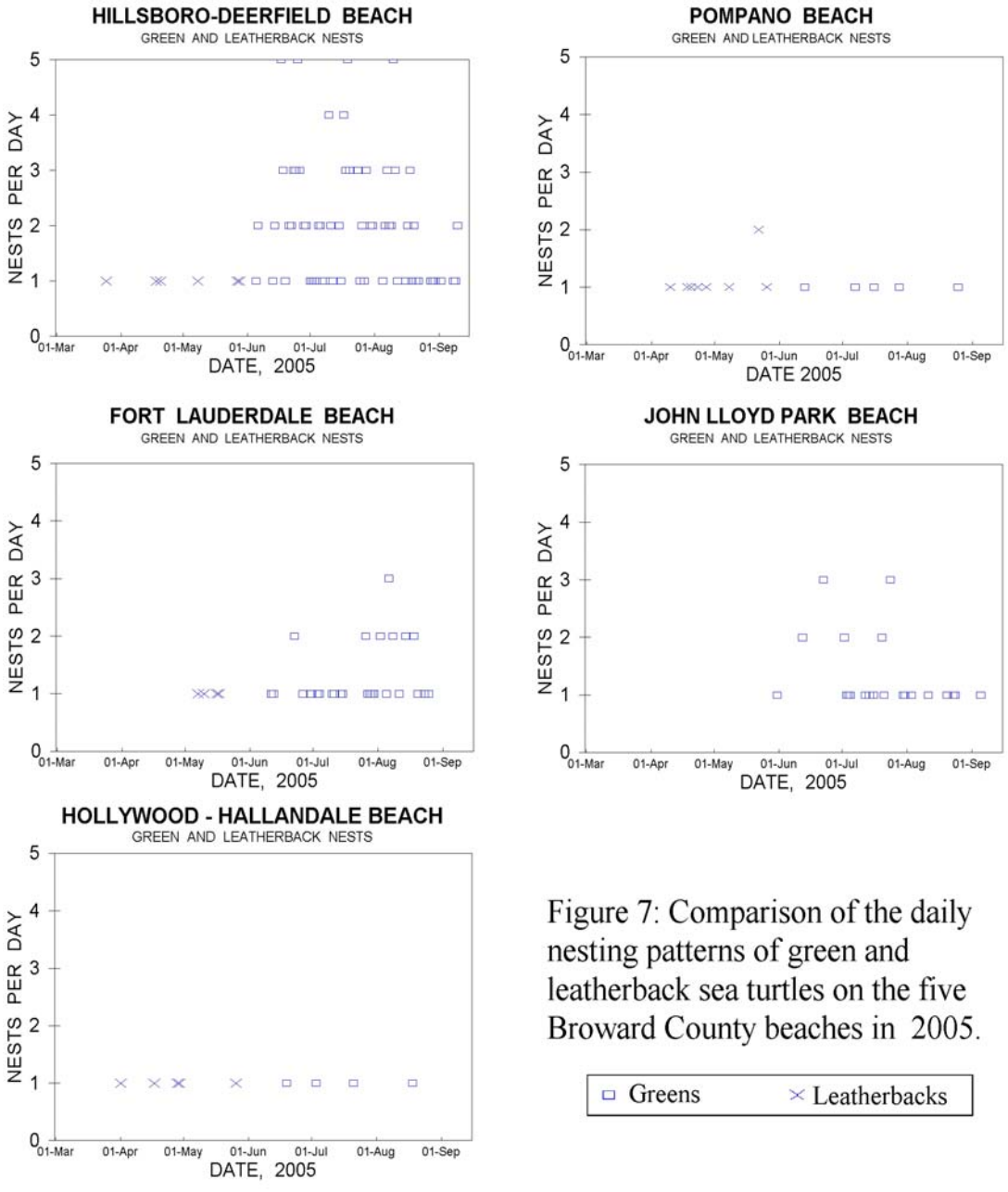


Figure 7: Comparison of the daily nesting patterns of green and leatherback sea turtles on the five Broward County beaches in 2005.

Table 2: Total green turtle nests and nesting densities expressed as nests-per-kilometer for the 2005 season. Beaches with the same NK designation letters were not significantly different in a Newman-Keuls test (alpha = .05) of mean daily nesting per km (1 May-30 Sep). Beaches with different NK letters had significantly different nesting densities.

BEACH	TOTAL NESTS	BEACH LENGTH (km)	Nests per km	MEAN DAILY NESTS per km with NK Designation Letter
Hillsboro Beach	139	7.0	19.9	.1289 A
Lloyd Park	28	3.9	7.2	.0469 B
Ft. Lauderdale	34	10.6	3.2	.0210 C
Pompano Beach	5	7.7	0.6	.0042 C
Hollywood	4	9.4	0.4	.0028 C
OVERALL	210	38.6	5.4	

Table 3: Total leatherback nests and nesting densities expressed as nests-per-kilometer for the 2005 season. There were no significant differences in mean daily nests per km.

BEACH	TOTAL NESTS	BEACH LENGTH (km)	Nests per km	MEAN DAILY NESTS per km 1 Mar-30 Jun
Hillsboro Beach	7	7.0	1.0	.0081
Pompano Beach	9	7.7	1.2	.0096
Ft. Lauderdale	4	10.6	0.4	.0031
Lloyd Park	0	3.9	0	0
Hollywood	5	9.4	0.5	.0044
OVERALL	25	38.6	0.6	

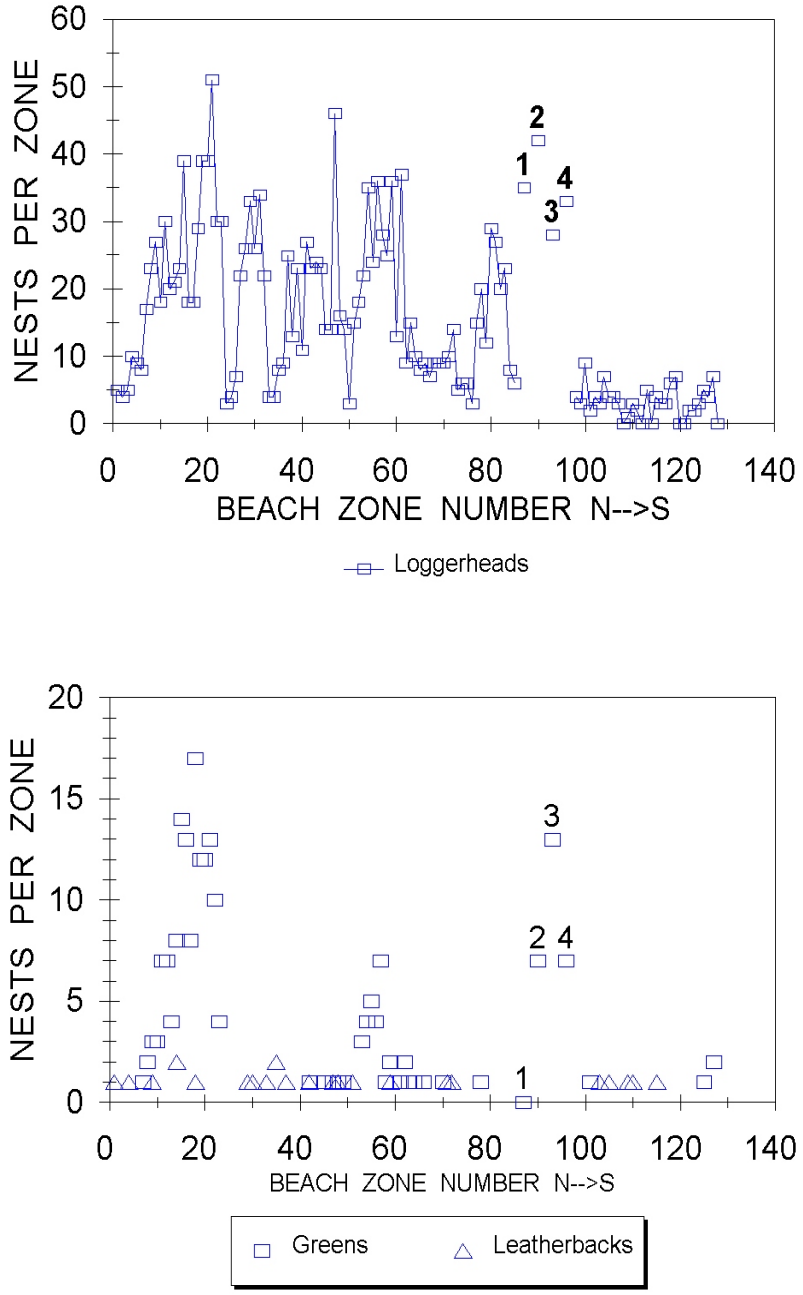


Figure 8: Locations of loggerhead, green and leatherback nests in Broward County, 2005. Numbers 1-4 indicate the four beach zones of John Lloyd Park.

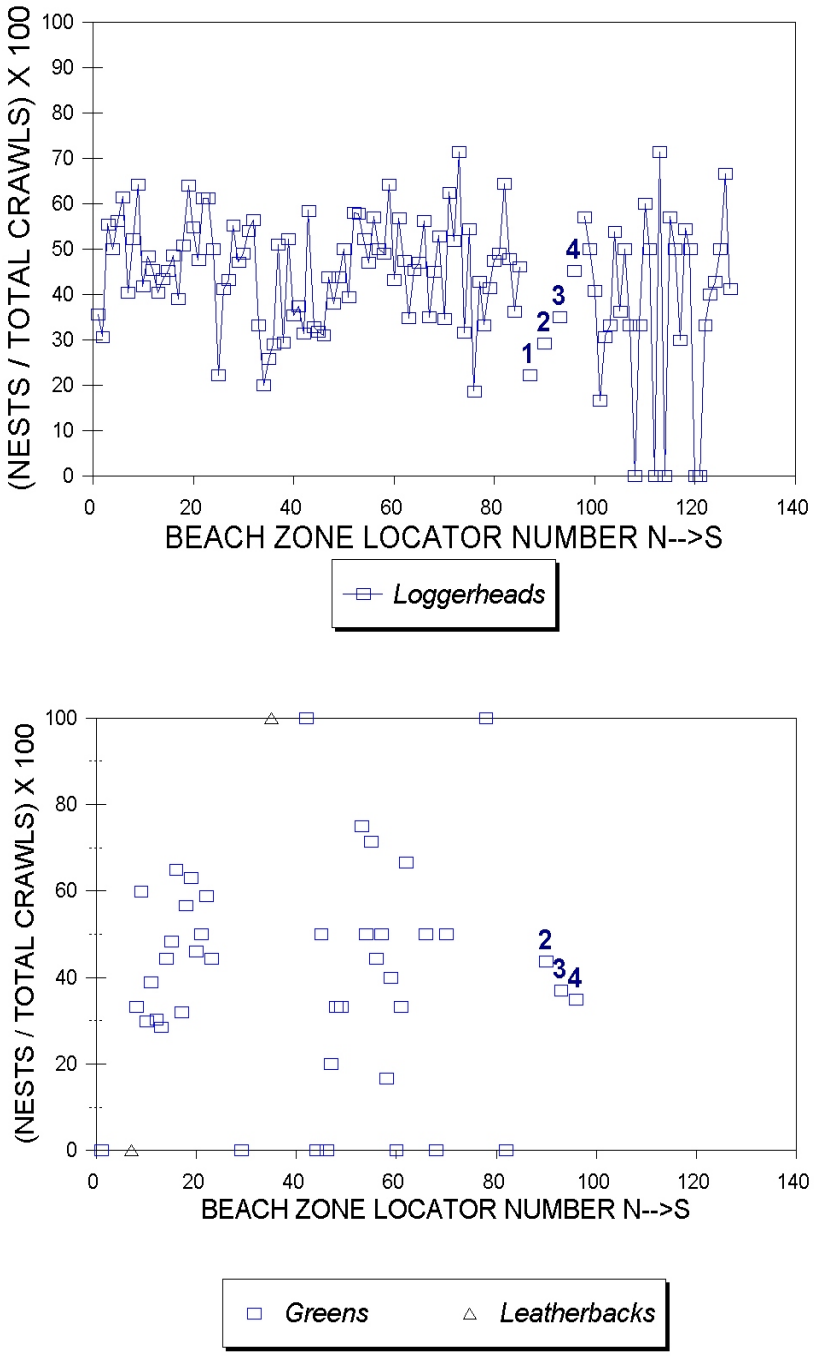


Figure 9: The distribution of the nesting success of loggerhead, green and leatherback turtles across Broward County, 2004. Numbers 1-4 indicate the four beach zones of John Lloyd Park.

Table 4: Total nests, false crawls (FC) and percent nesting success (NS) for three sea turtle species on each of five Broward County beaches during 2005. Newman-Keuls (NK) designations for loggerheads as in Table 2. One-way ANOVA detected no significant differences in mean nesting success for greens or leatherbacks.

BEACH	Loggerheads				Greens			Leatherbacks		
	Nests	FC	NS	NK	Nests	FC	NS	Nests	FC	NS
Hillsboro Beach	526	520	50.3	A	139	169	45.1	7	4	63.6
Pompano Beach	474	672	41.4	A	5	11	31.3	9	0	100
Hollywood	101	146	40.9	A	4	6	40.0	5	2	71.4
Ft. Lauderdale*	580	621	48.3	AB	34	38	47.2	4	1	80.0
Lloyd Park	138	315	30.5	B	28	44	38.9	0	1	0
OVERALL	1819	2274	44.4		210	268	43.9	25	8	75.8

* Plus one hawksbill (*Eretmochelys imbricata*) nest

numbers of nests left *in situ*. Table 6 lists the number of eggs and released hatchlings from evaluated *in situ* and relocated nests. The numbers of predated nests and nests that were unevaluated due to stake removal or washout are also listed. A total of 173 nests were not evaluated due to stake loss, washout or burial by Hurricanes Dennis, Katrina and Rita.

Compared to last year, the release success (live hatchlings released / total eggs) of relocated loggerhead nests decreased 6.1 percentage points to 53.3 percent, while the success of *in situ* loggerhead nests increased by 9.3 points to 73.0 percent (Table 6). The difference between *in situ* and relocated nests increased from 4.3 percent last year to 19.7 percent in 2005. *In situ* green turtle nests hatched at a rate of 80.7 percent compared to 38.9 percent in relocated nests. Because of the apparent adverse effects of relocation, only 11 green turtle nests (6 percent of total) which were in danger from washout (less than 10 feet from previous high tide line) or beach nourishment were relocated and 6 were evaluated. Five leatherback nests were moved from Hollywood beach due to the nourishment project. These nests produced 33.3 percent live hatchlings compared to 59.5 percent for the 13 evaluated *in situ* nests. Figure 10 illustrates the historical patterns of yearly release success for all evaluated *in situ* and relocated sea turtle nests since 1981.

Figure 11 shows the seasonal patterns of the release success of *in situ* and relocated loggerhead nests. The success of relocated nests showed the usual significant seasonal decline ($P<<.001$) but the slope was much steeper than in previous years. The success of in situ nests also declined steeply. The slopes of the two trend lines were not significantly different ($P = .07$). Most (91 percent) *in situ* nests were

Table 5: Total Number of loggerheads, greens leatherback nests relocated or left *in situ* in 2005.

	Loggerheads	Greens	Leatherbacks	Totals
RELOCATED				
<u>Open Beach</u>				
Hillsboro Beach				
BH900s	39	2	0	41
BH1000s	54	1	0	55
BH1100s	59	0	0	59
BH1200s	10	1	0	11
BHR 22-24	20	0	0	20
Pompano Beach				
BP1	245	1	0	246
BP2	287	1	0	288
BP3	273	1	0	274
Lloyd Park Beach	72	4	0	76
<u>Hatcheries</u>				
Pompano	59	0	0	59
Ft. Lauderdale	53	0	0	53
Hollywood	26	0	5	31
TOTALS	1197	11	5	1213
IN SITU				
Hillsboro Beach	344	135	7	486
Pompano Beach	128	5	9	142
Ft. Lauderdale	9	31	4	44
Hollywood	3	0	0	3
TOTALS	484	171	20	675
GRAND TOTALS	1681	182	25	1888

Plus one hawksbill nest in Fort Lauderdale, relocated to BP3

Table 6: Total egg counts, released hatchlings and overall release successes for *in situ* and relocated nests of loggerheads, greens and leatherbacks in 2005, with the numbers of nests and eggs predated, lost and unevaluated due to Hurricane Dennis (A), Katrina (B) and Rita (C).

SPECIES	NUMBER OF EGGS	EVAL. NESTS	HATCHLINGS RELEASED	RELEASE SUCCESS (%)
***In situ* Nests**				
C. caretta	21622	208	15791	73.0
C. mydas	5063	46	4084	80.7
D. coriacea	1046	13	622	59.5
Total	27731	267	20497	73.9
Relocated Nests				
C. caretta	113882	1061	60683	53.3
C. mydas	643	6	250	38.9
D. coriacea	484	5	161	33.3
E. imbricata	95	1	13	13.7
Total	115104	1073	61107	53.1
Overall				
C. caretta	135504	1269	76474	56.4
C. mydas	5706	52	4334	76.0
D. coriacea	1530	18	783	51.2
E. imbricata	95	1	13	13.7
TOTAL	142835	1340	81604	57.1

Predated and Unevaluated Nests and Eggs

	Pred. Nests	Pred. Eggs	Uneval Nests	Uneval Eggs	Hurricanes		
					A	B	C
In Situ							
C. caretta	74	-	202	-	0	32	24
C. mydas	12	-	113	-	0	9	17
D. coriacea	0	-	7	-	0	0	0
Relocated							
C. caretta	113	12232	23	2303	6	49	33
C. mydas	2	240	3	316	0	1	2
D. coriacea	0	0	0	0	0	0	0
E. imbricata	0	0	0	0	0	0	0

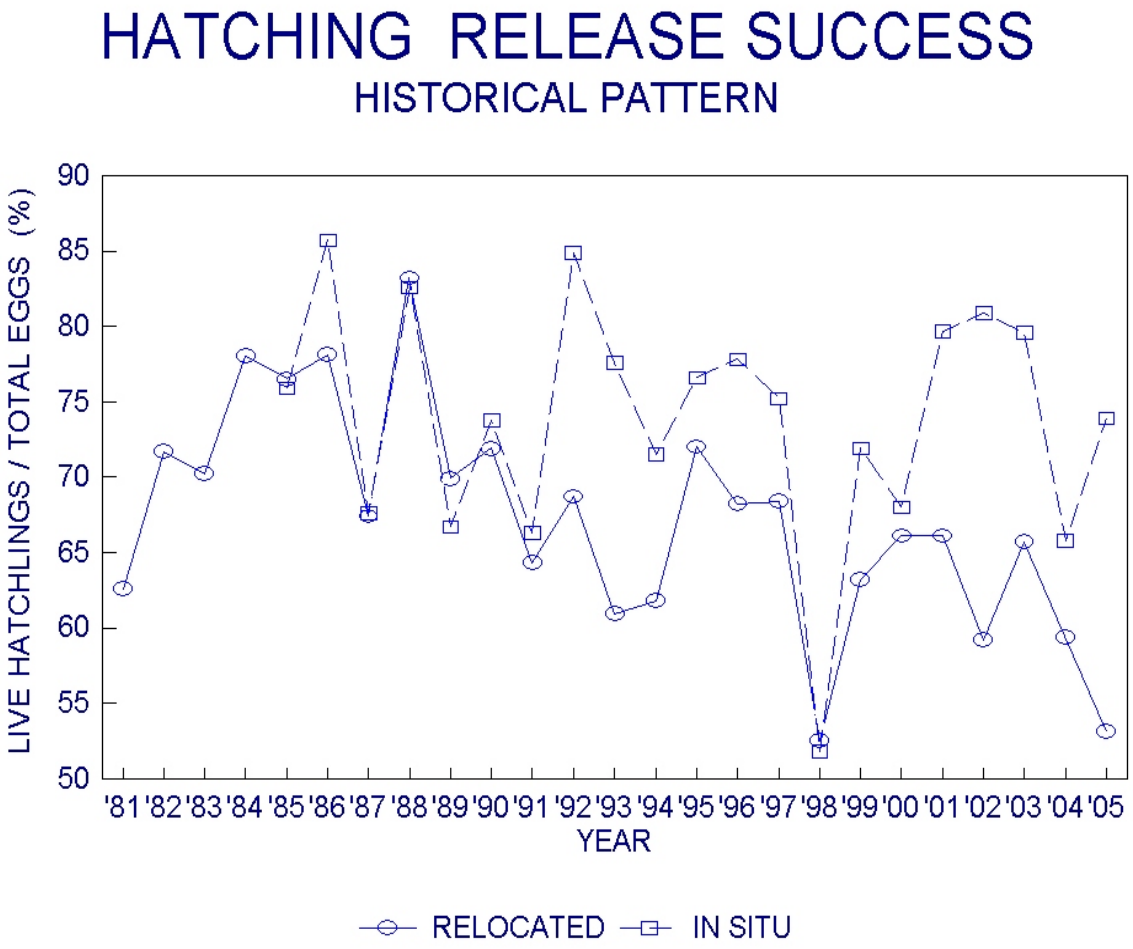


Figure 10: The historical patterns of yearly hatching release success for all evaluated *in situ* and relocated sea turtle nests, since 1981.

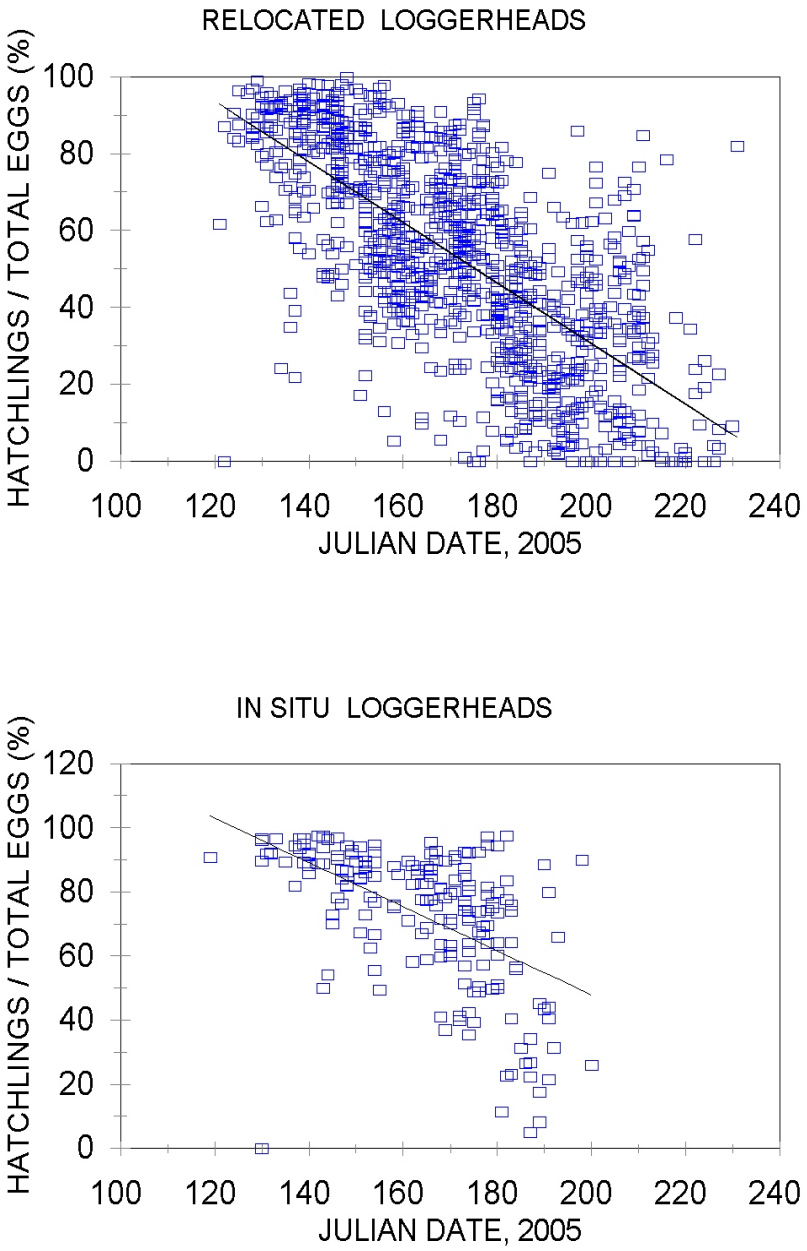


Figure 11: Comparison of seasonal hatching release success for relocated and *in situ* loggerhead nests during 2005.

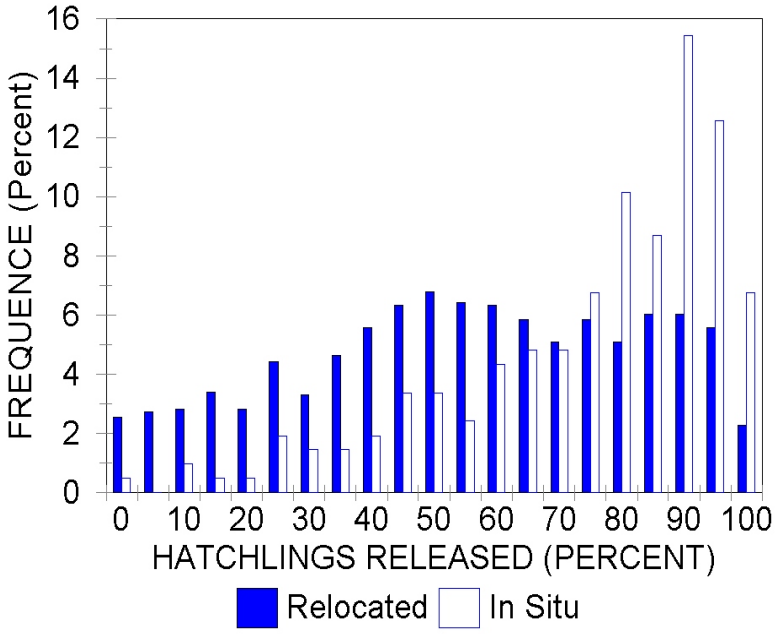


Figure 12: Hatching release success frequencies for *in situ* and relocated loggerhead nests in 2005.

evaluated prior to Julian day 185 (July 4) while 29 percent of relocated nests were deposited after this date. The disproportionate number of late season nests must be considered when comparing the overall success of relocated and *in situ* nests (Table 6, Fig. 10).

Figure 12 shows the frequency distributions for hatching success in relocated and *in situ* nests. A Mann Whitney U test indicated a significant difference in the medians of these distributions ($Z = 9.61$, $P << .001$). Figure 13 compares the success of relocated and *in situ* loggerhead nests by the month of deposition. Incubation conditions deteriorated later in the season. This was probably related to unusually high temperature and Hurricanes Katrina and Rita. An analysis of this is included in the Discussion.

Table 7 compares emergence success and the percentages of hatchlings and eggs in the post-hatching evaluation categories for

relocated and *in situ* loggerhead nests. Tables 8, 9 and 10 give the same results for greens, leatherbacks and the single hawksbill, respectively.

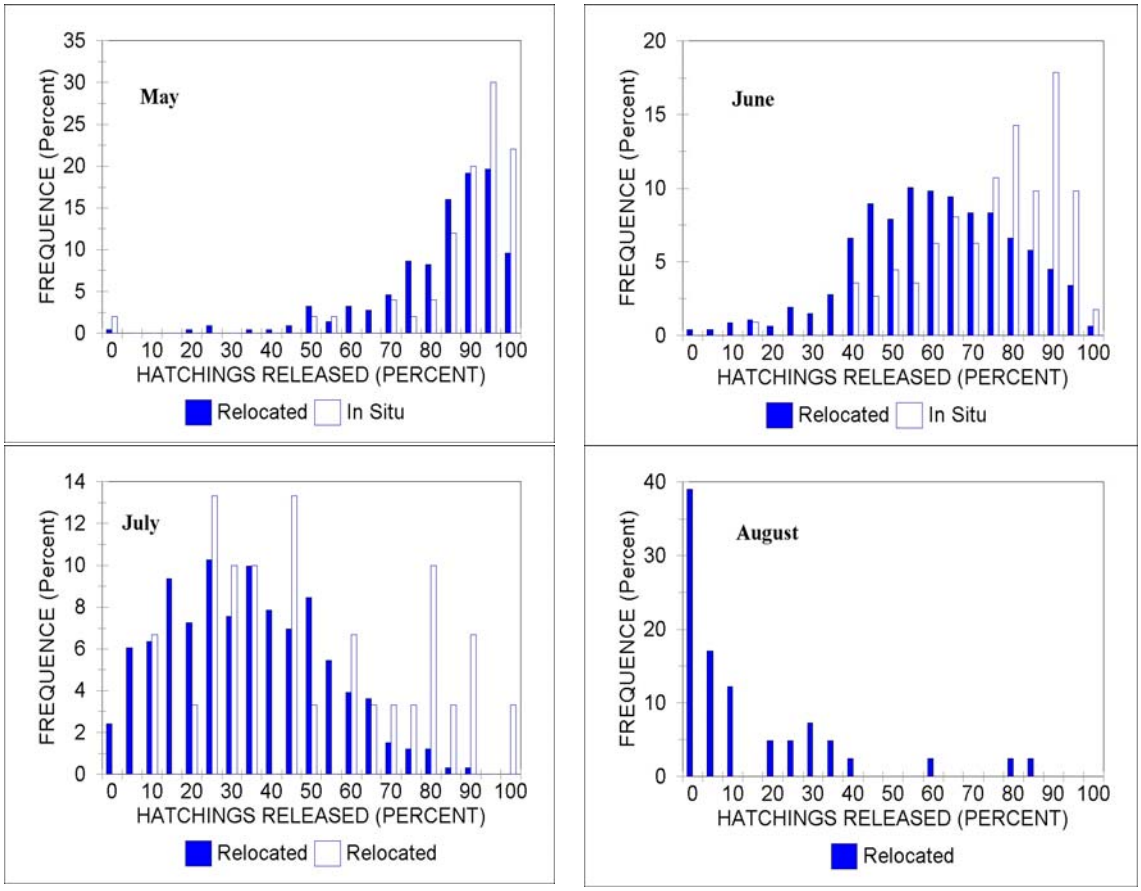


Figure 13: Comparisons of the success of relocated and *in situ* loggerhead nests deposited in May, June, July and August.

Table 7: Accounting of the status of all hatched and unhatched eggs in evaluated *in situ* and relocated loggerhead nests during 2005.

Location	Total Eggs	Emerged Hatchlings (%)	LIN (%)	DIN (%)	PIP Live (%)	PIP Dead (%)	VD (%)	NVD (%)
***In situ* Nests**								
Hillsboro Beach	14607	65.8	6.5	2.9	0.7	5.7	9.0	9.3
Pompano Beach	6661	63.5	7.8	3.1	0.9	7.5	13.2	4.2
Ft. Lauderdale	165	86.7	1.8	0.6	1.2	0	1.8	7.9
Hollywood Beach	189	86.2	4.2	0.5	0.5	2.6	2.1	3.7
Overall In situ	*21622*	*65.4*	*6.8*	*2.9*	*0.8*	*6.2*	*10.2*	*7.7*
Relocated Nests								
Hillsboro Beach								
BH900s	3357	43.8	7.6	2.6	1.1	8.3	16.0	20.6
BH1000s	4507	62.3	6.8	3.6	0.9	6.5	8.2	11.8
BH1100s	2691	44.4	3.6	2.0	0.5	8.0	24.3	17.2
BH1200s	138	34.8	4.3	0.7	0.7	8.7	31.9	18.8
BHR22-24	1778	75.5	3.2	3.6	0.4	8.3	2.6	6.4
Overall Hillsboro	*12471*	*55.0*	*5.8*	*3.0*	*0.8*	*7.6*	*13.2*	*14.6*
Pompano Beach								
BP1	27522	46.5	13.4	3.6	2.2	16.7	6.1	11.6
BP2	29596	29.2	11.6	3.4	1.7	16.9	20.8	16.4
BP3	28061	26.5	8.6	4.1	1.4	14.3	24.5	20.6
Overall Pompano	*85179*	*33.9*	*11.2*	*3.7*	*1.8*	*16.0*	*17.3*	*16.2*
Lloyd Park Beach	163	89.0	0	0.6	0	2.5	0	7.9
Restraining Hatcheries								
Pompano	6756	63.7	7.4	3.8	1.4	11.4	1.9	10.4
Ft. Lauderdale	6314	76.5	9.8	1.5	1.3	4.5	1.6	5.2
Hollywood	2999	79.5	5.1	1.1	0.5	1.1	1.6	10.8
Overall Hatchery	*16069*	*71.7*	*7.9*	*2.4*	*1.2*	*6.8*	*1.7*	*8.4*
Overall Relocated	*113882*	*41.6*	*10.1*	*3.4*	*1.6*	*13.7*	*14.6*	*14.9*

Table 8: Accounting of the status of all hatched and unhatched eggs in

investigated *in situ* and relocated green sea turtle nests during 2005. Abbreviations as in Table 7.

Location	Total Eggs	Emerged Hatchlings (%)	LIN (%)	DIN (%)	PIP Live (%)	PIP Dead (%)	VD (%)	NVD (%)
***In situ* Nests**								
Hillsboro Beach	4195	71.0	8.7	3.6	0.6	6.6	6.4	3.2
Ft. Lauderdale	868	75.8	6.7	2.4	0.3	1.6	9.8	3.3
Overall In situ	*5063*	*71.8*	*8.4*	*3.4*	*0.5*	*5.7*	*7.0*	*3.2*
Relocated Nests								
BH900s	82	68.3	15.9	6.1	4.9	2.4	2.4	0
BH1000s	110	34.5	0	0	0	0.9	38.2	26.4
BH1200s	118	0	1.7	0	0.8	5.9	89.8	1.7
Pompano Beach								
BP1	116	1.7	44.8	4.3	6.9	16.4	6.0	19.8
BP2	89	69.7	7.9	0	0	13.5	4.5	4.5
BP3	128	3.1	0.8	0	0	0.8	49.2	46.1
Overall Relocated	*643*	*25.2*	*11.7*	*1.6*	*2.0*	*6.5*	*34.8*	*18.2*

Table 9: Accounting of the status of all hatched and unhatched eggs in investigated *in situ* and relocated leatherback nests during 2005. Abbreviations as in Table 7.

Location	Total Eggs	Emerged Hatchlings (%)	LIN (%)	DIN (%)	PIP Live (%)	PIP Dead (%)	VD (%)	NVD (%)
***In Situ* Nests**								
Hillsboro Beach	350	57.7	11.1	8.3	0.9	5.4	7.4	9.1
Pompano Beach	303	56.4	6.6	19.8	0	0.3	5.0	11.9
Ft. Lauderdale	393	39.2	8.1	10.2	0.3	2.0	6.9	33.3
Overall In situ								
Relocated Nests								
Restraining Hatcheries								
Hollywood	484	28.5	4.3	0.8	0.4	3.1	11.0	51.8

Table 10: Accounting of the status of all hatched and unhatched eggs investigated in a relocated hawksbill nest during 2005. Abbreviations as in Table 7.

Location	Total Eggs	Emerged Hatchlings (%)	LIN (%)	DIN (%)	PIP Live (%)	PIP Dead (%)	VD (%)	NVD (%)
Relocated Nests								
Ft. Lauderdale	95	4.2	9.5	1.1	0	17.9	54.7	12.6

DISCUSSION

Yearly Nesting Trends

The influence of fluctuations in the percentage of the adult female population that nests in a given year and of the average number of clutches deposited per female on the total number of nests per season was discussed in last years report (Burney and Ouellette, 2004). Although variations in these parameters might explain the decline in nesting since 2000, the lack of recovery this year strengthens the suggestion that the size of the nesting population has declined since the late 1990s.

Green turtle nesting was unusually high this year and seems to have broken the well-established pattern of higher nesting in even numbered years. The nest count last year was unusually low for an even numbered year (Fig. 3) and some of the females may have extended their remigration interval and waited until 2005 to nest.

Leatherbacks were active on all Broward County beaches in 2005. There were no nests deposited in Lloyd Park (Table 3), but there was one false crawl (Table 4). Leatherbacks have not failed to nest in Broward County since 1982.

The incidental hawksbill nest deposited in Fort Lauderdale was originally identified as a loggerhead and the true species was recognized during post hatching evaluation. It is possible that some other nests of this species have occurred in the County, but the last known instance was in 1994.

Seasonal Nesting Patterns

The seasonal loggerhead nesting pattern (Fig. 4) was very similar to last year. The curve was relatively symmetrical with the midpoint of the season in mid to late June. There may have been somewhat greater fluctuation in daily nesting in the first half of the season compared to previous years. The largest daily nest count (41) was on 1 June, considerably before the peak of the seasonal pattern.

Seasonal nesting at the individual beaches (Fig. 5) was similar to previous years. Loggerhead nesting densities throughout Broward County were highest in the north and declined toward the south (Table 1). Nesting decreased by 10.4 percent in Hillsboro Beach, increased 5.8 percent in Pompano Beach and was nearly constant in Fort Lauderdale and Lloyd Park relative to last year. Nesting on Hollywood beach increased from 76 nests in 2004 to 101 in 2005. Only 2 nests were deposited on the nourished beach. The others were laid on the old sand before the nourishment project reached their locations.

The seasonal pattern of green turtle nesting in 2005 (Fig. 6) was similar to other high nesting years (Burney and Ouellette, 2002, 2004). Nesting commenced in early June and ended in mid September. A maximum of 8 nests per day per were deposited throughout the county. Leatherbacks again nested earlier in the season, from late March to late May.

As in previous years, green turtles nested most densely in Hillsboro Beach (Table 2; Fig.7), possibly due to the reduced beachfront lighting and nocturnal human activity. Lloyd Park was the next most heavily nested location, which also has restricted night access. Mean daily nesting densities were lowest in Pompano Beach, Fort Lauderdale and Hollywood, which were statistically equivalent. This pattern was similar to last year. The 4 green turtle nests deposited on Hollywood beach were the first since 2002. Leatherbacks nested most densely in northern Broward County but there was leatherback activity on all beach sections (Table 4). Analysis of the leatherback nesting sequence showed that 6 nests were deposited between 17 April and 23 April and again between 22 and 28 May. If the minimum inter-nesting interval for this species is 9 days (Eckert et al., 1989; Miller, 1997) this indicates that a minimum of 6 different individuals nested in Broward County this year.

Countywide Nest Distribution

The distribution of loggerhead nests in the 128 survey zones (Fig. 8) continues to highlight shoreline features identifiable since 1981. As in past surveys, beaches near piers, inlets, the Fort Lauderdale strip and throughout Dania, Hollywood and Hallandale remained lightly nested. This pattern has been discussed previously (Burney and Mattison, 1992; Mattison et al., 1993). Low nested zones are generally characterized by high levels of artificial lighting and nocturnal human activity. (Mattison, 2002). Green turtles again demonstrated their apparent preference for darker beaches with less nocturnal disturbance (Fig. 8).

Nesting Success

Figure 14 shows the trends in loggerhead nesting success for the 5 beaches since 2000. Prior to 2004, false crawls were counted only if they

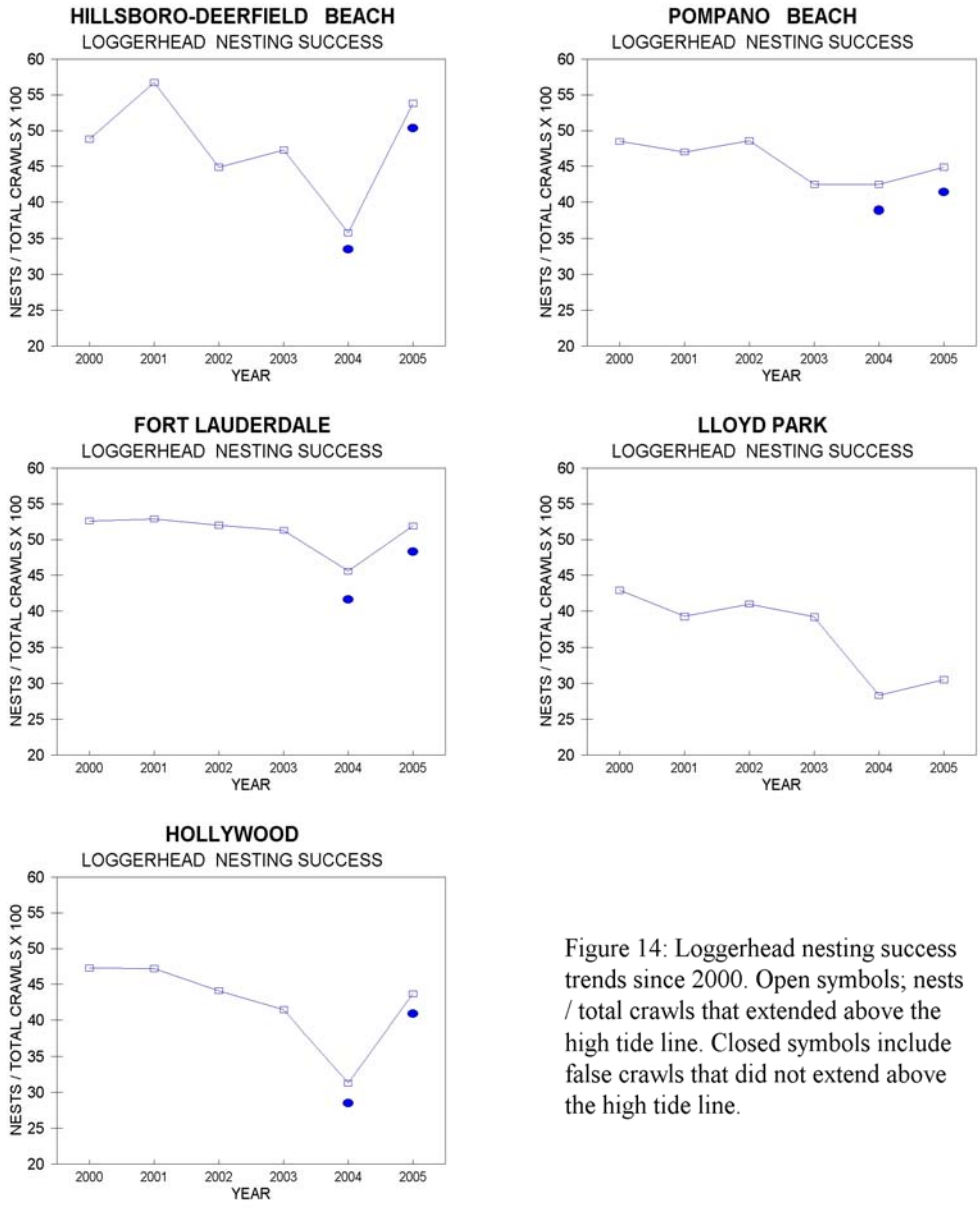


Figure 14: Loggerhead nesting success trends since 2000. Open symbols; nests / total crawls that extended above the high tide line. Closed symbols include false crawls that did not extend above the high tide line.

extended above the previous high tide line. During the last two seasons, false crawls that did not reach the previous high tide line were also counted, but were listed separately. The closed symbols give the nesting success with these crawls included. Hillsboro Beach experienced significant natural sand accretion in 2005, before erosion again became serious in late August. This may explain the dramatic increase in loggerhead nesting success this year. Pompano Beach and Fort Lauderdale have experienced only minor

fluctuations over the past 6 years. Overall loggerhead nesting success in Lloyd Park declined in 2004 and increased very slightly this year. Figure 9 shows that nesting success was low in the south end of the Park (zone 1) where erosion was severe due to blockage of longshore sand movement by the Port Everglades jetty, but it increased toward the north as erosion diminished and rose to the county average in zone 4. It appears that loggerhead nesting success was not adversely impacted by the removal of Australian Pines that increased beach lighting in the north end of the Lloyd Park. However, the pattern of green turtle nesting success in Lloyd Park was the reverse of the loggerhead trend (Fig. 9), which may have been due to increased light intensities toward the north. Hollywood showed a surprising increase in loggerhead nesting success from last year. Apparently, the beach nourishment project did not increase the number of non-nesting crawls on other sections of the beach. Two loggerheads nested on the nourished beach and were relocated to Lloyd Park. Both nests were predated. Two loggerheads and one leatherback collided with the pipeline or stored pipes and returned to the sea. One loggerhead made a non-nesting crawl in the buffer zone of the construction project without interacting with any beach obstacles. Another loggerhead briefly appeared in the construction pit while work was in progress but it immediately swam away without crawling. There were an additional 5 loggerhead false crawls on finished sections of the nourished beach after the project had moved away.

Hatchling Release Success

The percentage of loggerhead eggs that produced live hatchlings declined sharply from last year for relocated nests and increased for *in situ* nests. The 19.7 percentage point difference was highly significant but the difference is not entirely due to the relocation process. Figure 11 shows that

the percentage of live hatchlings/total eggs showed the usual seasonal decline, but the rate of decline was higher than for any other year since this analysis began in 1989 and the slopes of the trend lines for relocated and *in situ* nests were not statistically different. However, 29 percent of the relocated nests were deposited after July 5 (Julian day 185) while only 9 percent of evaluated *in situ* nests were laid after this date. Since the overall success rate of relocated nests includes a higher proportion of late-season, low-hatching nests, this accounts for part of the difference in the overall successes of relocated and *in situ* nests (Table 6). The greater proportions of low-success relocated nests are clearly shown in Figure 12. Figure 13 shows that distributions of the successes of relocated and *in situ* nests deposited in May were similar, with very low frequencies of successes less than 20 percent. June nests showed the usual shifting of the mode of the relocated distribution to a lower percentage, while the *in situ* mode remained higher, but still with very low frequencies less than 20 percent. The mode of the relocated distribution for July nests was shifted even lower but maximum *in situ* frequencies were also lower, in the 45 and 25 percent ranges. Most of the July *in situ* nests were deposited early in the month. In August, the mode of the distribution of the 41 relocated nests was zero. No *in situ* nests laid in August were evaluated.

Workers evaluating late season nests reported that the unhatched eggs appeared unusually dried out and that most of the failed eggs contained embryos that died at an early stage of development. Figure 14 compares the mean daily success (percent live hatchlings/total eggs) to the deviation of the mean daily air temperature from the seasonal average (temperature anomaly) at Miami International Airport (NOAA, National Climatic Data Center). There was a significant inverse relationship ($P < .0001$) between the temperature

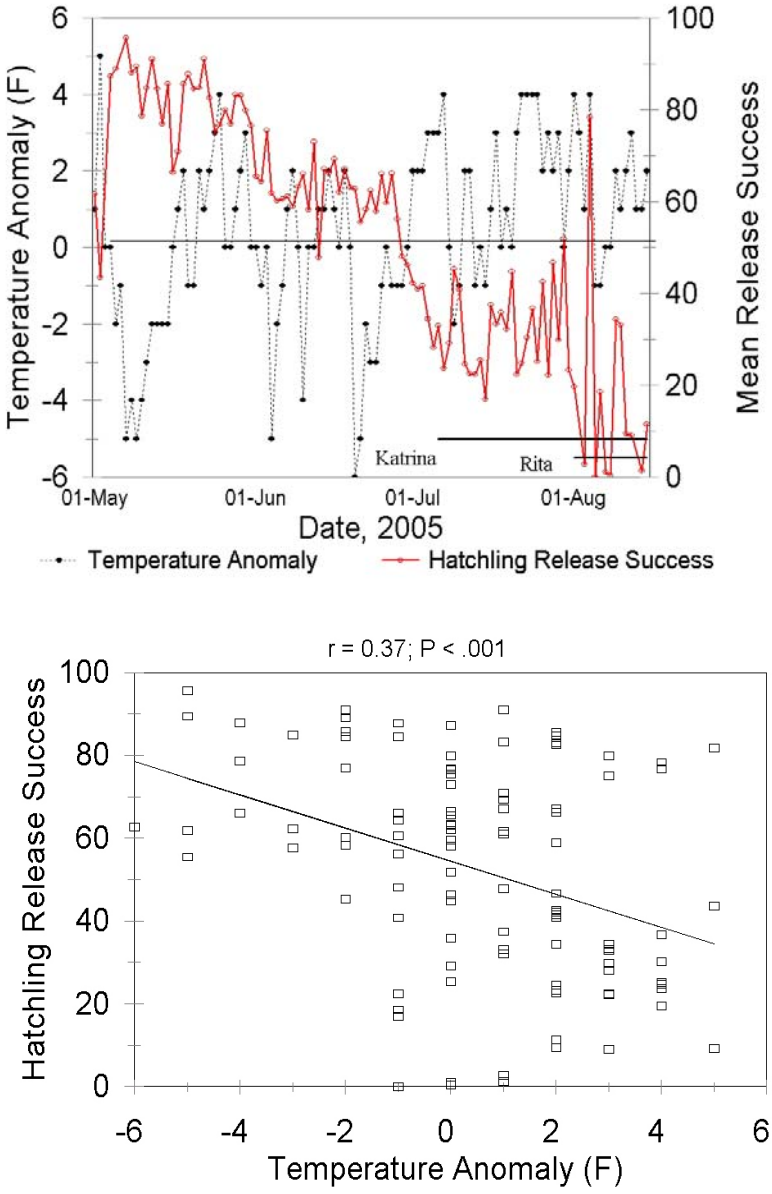


Figure 15: Relationship of mean daily hatchling release percent versus the daily air temperature deviation from the seasonal average (temperature anomaly). Horizontal lines span the deposition dates of nests that were impacted by hurricanes Katrina and Rita.

anomaly from May through mid August and the average daily success rate of loggerhead nests in 2005. This was not found in an analysis of the previous two years. In 2005 there were a total of 14 days in July and August with average temperatures 4 or 5 °F (2.2 or 2.7 °C) above normal. There were a total of 6 such days in 2004 and none in 2003. Mean daily success rates were less than 50 percent for nests deposited during the 50 days preceding the impact of Hurricane Katrina on August 25. Nests laid in the first two weeks of August were also impacted by Hurricane Rita. Mean daily success rates were less than 10 percent on 7 days during this period. It appears that the high temperature anomalies in July and August, coupled with the effects of two hurricanes, contributed to the unusually low successes of late season nests.

Post Emergence Nest Analysis

Comparison of the post emergence nest evaluation categories for loggerhead nests shows that the lowest emergence and some of the highest VD and NVD percentages occurred at the Pompano Beach open hatcheries BP2 and BP3, which were different from BP1 which had higher emergence and lower VD and NVD. This is because the BP1 location received nests from 24 May through 13 June while hatcheries BP2 and BP3 received nests laid from 14 June through July 30 and from 15 June through 8 August, respectfully (Appendix 3). Since the BP2 and BP3 nests were laid later, they were more intensely impacted by the high temperatures and hurricanes. Nests relocated to some sections of Hillsboro Beach had high VD and NVD percentages but they were not based on large numbers of eggs and some of the nests may have been deposited in July or August. The open beach hatcheries in Pompano Beach had generally higher percentages of PIP Dead

and LIN, but not PIP Live, relative to other areas. Since double-digit percentages in these categories were not found at the relocation sites in Hillsboro Beach, the results at Pompano Beach must have been due to site-specific beach characteristics or to nest transportation effects.

Few conclusions can be drawn from the analysis of the nest evaluation categories for greens or leatherbacks due to the small number of relocated and evaluated *in situ* nests, other than that relocation appears to adversely impact these nests and should be avoided unless there is the certainty of even more negative impacts such as burial during beach nourishment.

Management Issues

The main issues confronting the management of sea turtle nesting in Broward County continue to be beach erosion and hatchling misorientation due to coastal lighting. These issues are interrelated because beach erosion in Hillsboro Beach has destroyed the traditional relocation site at the Hillsboro Club and forced the relocation of Fort Lauderdale and Pompano Beach nests to the open beach sites BP1 through BP3 in the latter city. These areas are much less suitable due to beach lighting and require extra effort to rescue misoriented hatchlings. Efforts are being made to solve the lighting problems. Several municipalities now have lighting ordinances and have started taking measures to ensure compliance, especially in Pompano Beach and Hallandale Beach, but much more needs to be done. If beach lighting can be substantially reduced, far fewer nests would require relocation.

REFERENCES

Burney, C.M. and C. Mattison. 1992. Sea Turtle Conservation Project, Broward County, Florida. 1992 Report. Marine Resources Section, Biological Resources Division, Department of Natural Resource Protection. Fort Lauderdale, Florida. 52 pp.

Burney, C.M. and S. Ouellette. 2002. Sea Turtle Conservation Project, Broward County, Florida. Technical Report 02-07. Marine Resources Section, Biological Resources Division, Department of Natural Resource Protection. Fort Lauderdale, Florida. 47 pp.

Burney, C.M. and S. Ouellette. 2003. Sea Turtle Conservation Project, Broward County, Florida. Technical Report TR03-08. Marine Resources Section, Biological Resources Division, Department of Natural Resource Protection. Fort Lauderdale, Florida. 113 pp.

Burney, C.M. and S. Ouellette. 2004. Sea Turtle Conservation Project, Broward County, Florida. Technical Report EPD 04-03. Marine Resources Section, Biological Resources Division, Department of Natural Resource Protection. Fort Lauderdale, Florida. 108 pp.

Eckert, S.A., K.L. Eckert, P. Ponganis and G.L. Kooyman. 1989. Diving and foraging behavior of leatherback sea turtles (*Dermochelys coriacea*). Can. J. Zool. 67: 2834-2840.

Mattison, C., C.M. Burney and L. Fisher. 1993. Trends in the spatial distribution of sea turtle activity on an urban beach (1981-1992). Proceedings of the 13th Annual Symposium on Sea Turtle Biology and Conservation. Jekyll Island Georgia, 23-27 February, 1993. p 102-104.

Mattison, C. 2002. The influence of physical and anthropogenic factors on the distribution of loggerhead sea turtle (*Caretta caretta*) nests in Broward County, Florida (1990-1999). Masters Thesis, Nova Southeastern University. 90 pp.

Miller, J.D. 1997. Reproduction in sea turtles, p. 51-81. In: The Biology of Sea Turtles. P.L. Lutz and J.A. Musick (eds.). CRC Press, Boca Raton, Florida.

NOAA, National Climatic Data Center.

http://www.ncdc.noaa.gov/oa/ncdc.html

APPENDIX 1: Summary of sea turtle emergency cell phone calls.

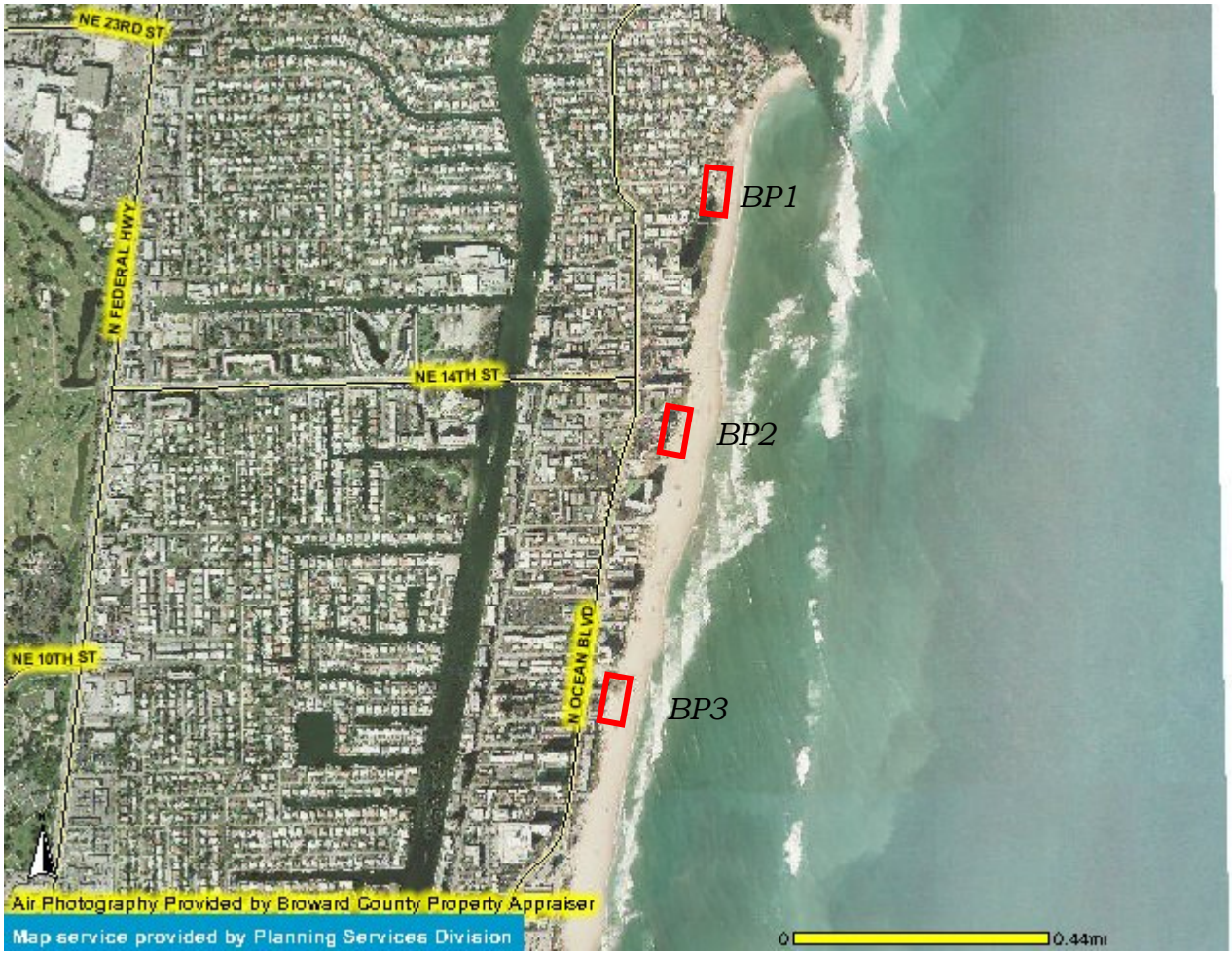
SUBJECT	HOT-LINE
ATV ACCIDENTS	0
LIVE STRANDINGS	10
DISORIENTATIONS	2
NEST LOCATIONS	50
POACHING	0
OTHER	>200
OVERALL	> 250

APPENDIX 2: Summary of Educational/Public Information Activities

Flyers were distributed along the beach, primarily to people who approached workers with questions, and at the turtle talks, and at schools that were visited. Flyers were also available at all fenced hatcheries.

A total of 27 public education talks were conducted from June 28 to Sept. 2 at the Anne Kolb Nature Center. These slide show presentations were followed by hatchling releases. A total of 1179 people attended these events. Turtle talks were also given at the following locations.

1) Griffin Elementary after school Environmental Group (March 9)
2) Pioneer Middle School: Environmental Awareness Week (Mar. 11); Six talks
3) Nova Southeastern University: Earth Day (Apr. 22)
4) Nova University School (Apr. 29)
5) Hollywood Open House: 1600 S. Park Rd. (May 7)
6) Museum of Discovery and Science, World Ocean Day (Jun. 4)
7) South Florida Divers (Jul. 6)
8) Broward Community College (Aug. 2) two talks
9) Nova RA Orientation (Jul. 28 & Aug. 11)
10) Girl Scouts (Aug. 20)
11) South Plantation High School (Sep. 14)
12) Nova Southeastern University. (Oct. 11)
13) Birch State Park camp group; 3 talks.



Appendix 3: Precise locations of the open beach hatcheries in Pompano Beach. Hillsboro Inlet is at the top. The northerly and southerly limits of this area are shown in Figure 1C. The nest placement within each hatchery follows.

Open Beach Hatchery 2005

BP1

Zone R26

N26.25325
W080.08419

N26.25365
W0180.08414

N--->

Row																														
9																							FT219	FT218	FT222	FT221	FT217	FT220		
																							6/13	6/13	6/13	6/13	6/13	6/13		
8	P182	FT223	P186	P180	P185	FT224	P184	P181	P183	FT216	FT212	FT214	FT213	P176	FT215	FT209	FT211	FT205	FT206	FT207	P170	P173	P175	P172	P174	P171	FT204	FT201	P165	FT202
	6/13	6/13	6/13	6/13	6/13	6/13	6/13	6/13	6/13	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/11	6/11	6/11	6/11	6/11	6/11	6/11	6/11	6/10	6/10	6/10	6/10
7	FT200	FT203	P162	P166	P164	P160	FT199	FT196	FT194	FT192	FT186	FT189	FT191	FT190	FT187	P161	FT195	FT188	FT193	P159	FT198	P158	P154	FT180	FT184	FT183	FT185	FT180	P155	P153
	6/10	6/10	6/10	6/10	6/10	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/9	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/8
6	FT181	FT173	FT169	FT170	FT172	FT174	FT178	FT171	FT175	FT179	P156	FT176	FT177	P157	FT166	FT160	P150	FT165	FT157	FT159	FT164	P151	FT158	FT156	FT161	FT162	FT163	FT168	FT167	P152
	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/8	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7	6/7
5	FT155	FT154	P145	P146	P149	P148	P147	FT153	FT151	P138	FT152	FT150	P143	FT145	FT146	FT149	FT148	P141	P140	FT143	FT147	FT144	FT142	P142	FT141	FT133	FT132	FT130	P137	P135
	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/5	6/4	6/4	6/4	6/4	6/4	6/4
4	FT135	FT134	FT131	P136	FT139	FT137	FT136	FT140	FT138	FT128	FT126	FT125	P133	FT129	FT127	P134	P132	FT124	P125	FT123	P127	P128	FT122	P126	FT115	FT113	FT114	FT108	P122	FT109
	6/4	6/4	6/4	6/4	6/4	6/4	6/4	6/4	6/4	6/3	6/3	6/3	6/3	6/3	6/3	6/3	6/3	6/2	6/2	6/2	6/2	6/2	6/2	6/2	6/1	6/1	6/1	6/1	6/1	6/1
3	P112	P114	FT116	FT117	FT110	FT112	P123	P120	P111	FT121	FT120	P124	FT118	P121	FT119	FT111	P110	P111	FT107	FT105	FT103	FT101	FT102	FT106	FT104	P107	P106	P105	FT100	P108
	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	6/1	5/31	5/31	5/31	5/31	5/31	5/31	5/31	5/31	5/31	5/30	5/30	5/30	5/30	5/30
2	FT98	FT99	FT95	P96	FT97	P99	FT96	P97	P97	FT94	P100	FT93	P94	FT85	P92	FT87	FT89	FT90	P91	FT86	FT88	FT92	P93	FT91	P87	P88	FT77	FT80	P76	P77
	5/29	5/29	5/28	5/28	5/28	5/28	5/28	5/28	5/28	5/28	5/28	5/28	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/27	5/26	5/26	5/26	5/26	5/26	5/26
1	FT84	P80	P83	FT81	P78	P84	FT76	FT83	P86	FT79	P90	FT82	P79	FT78	P81	FT75	FT74	P74	FT71	FT66	FT69	P75	FT67	FT73	FT72	FT70	P72	FT63	P73	FT62
	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/26	5/25	5/25	5/25	5/25	5/25	5/25	5/25	5/25	5/25	5/25	5/25	5/24	5/24	5/24	5/24

N26.25325
W080.08415

N26.25363
W080.08405

CM

Open Beach Hatchery 2005

BP2

Zone R29

N26.24714
W080.08529

N26.24746
W080.08532

Row																																
																														N--->		
10													FT612	P481	P480	FT608	FT609	FT606	FT604	FT603	FT601	P478	FT600	FT602	FT598	FT597	FT596	FT595	P476	P456	FT567
													8/19	8/18	8/15	8/15	8/15	8/14	8/14	8/14	8/12	8/12	8/12	8/12	8/11	8/10	8/10	8/10	8/9	7/30	7/30
9	P453	FT568	FT569	P455	P442	P444	FT555	FT554	FT556	P441	FT541	FT546	FT545	FT544	FT542	FT543	P439	P428	P429	P428	P429	FT527	FT529	FT524	FT525	FT526	FT528	FT523	FT522	FT521		
	7/30	7/30	7/30	7/30	7/30	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/26	7/26	7/26	7/26	7/26	7/26	7/26	7/24	7/24	7/24	7/24	7/24	7/24	7/24	7/24	7/22	7/22	7/22		
8	P425	FT514	FT512	FT513	FT515	FT516	P416	P417	P410	P415	P414	FT506	FT509	FT503	FT504	FT508	FT505	FT507	FT502	P398	P404	P399	P402	P403	FT491	FT488	FT490	FT487	FT493	FT492		
	7/22	7/20	7/20	7/20	7/20	7/20	7/20	7/20	7/20	7/20	7/20	7/18	7/18	7/18	7/18	7/18	7/18	7/18	7/18	7/18	7/18	7/18	7/18	7/18	7/16	7/16	7/16	7/16	7/16	7/16		
7	FT499	FT498	P391	P390	P392	FT477	FT473	FT474	FT475	FT478	FT472	P383	P386	P380	P385	P384	FT465	FT463	FT462	FT464	FT466	P373	FT467	P372	P374	FT446	FT445	FT444	FT447	FT449		
	7/16	7/16	7/16	7/16	7/16	7/14	7/14	7/14	7/14	7/14	7/14	7/14	7/14	7/14	7/14	7/14	7/12	7/12	7/12	7/12	7/12	7/12	7/12	7/12	7/12	7/10	7/10	7/10	7/10	7/10		
6	FT448	P364	FT450	FT436	P359	FT435	FT440	P356	P360	P357	FT439	FT438	FT442	P358	P353	P361	FT437	P352	P441	FT420	FT419	FT424	FT429	FT430	FT427	FT426	FT423	P336	FT425	FT421		
	7/10	7/10	7/10	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/6	7/6	7/6	7/6	7/6	7/6	7/6	7/6	7/6	7/6	7/6		
5	P342	FT428	FT422	P328	FT405	P327	FT406	FT400	FT395	FT399	FT398	FT397	FT394	P329	FT404	FT396	FT403	FT401	FT402	P330	FT407	P326	FT408	P314	P317	FT379	P318	FT382	FT380	FT381		
	7/6	7/6	7/6	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/4	7/2	7/2	7/2	7/2	7/2	7/2	7/2		
4	P315	P316	P319	FT369	FT363	FT371	FT364	P308	P307	P306	P310	FT368	FT367	P309	FT361	FT365	P305	P311	FT366	FT362	FT370	FT344	FT338	FT345	P294	P296	FT337	FT342	FT336	FT339		
	7/2	7/2	7/2	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/30	6/28	6/28	6/28	6/28	6/28	6/28	6/28	6/28	6/28		
3	FT340	FT343	FT341	P295	FT325	FT330	FT327	P284	FT326	P286	FT329	P285	FT331	P287	FT310	FT307	FT312	FT306	FT318	FT308	P273	FT314	FT309	FT315	FT311	FT317	FT319	P275	P272	FT316		
	6/28	6/28	6/28	6/28	6/26	6/26	6/26	6/26	6/26	6/26	6/26	6/26	6/26	6/26	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24	6/24		
2	P274	FT298	FT294	FT290	FT293	FT292	FT291	FT296	FT299	P257	P256	P253	P250	P254	P258	P255	FT266	P238	FT276	FT269	P243	FT270	FT268	FT274	FT275	P241	FT267	FT273	FT277	FT271		
	6/24	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/22	6/20	6/20	6/20	6/20	6/20	6/20	6/20	6/20	6/20	6/20	6/20	6/20	6/20	6/20		
1	FT272	P239	P242	P240	P237	FT257	FT258	P225	P219	P221	P223	P226	FT256	P224	FT255	FT237	FT238	FT239	FT240	FT241	P203	P190	P192	P191	FT226	FT228	P189	FT229	FT225	FT227		
	6/20	6/20	6/20	6/20	6/20	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/16	6/16	6/16	6/16	6/16	6/16	6/14	6/14	6/14	6/14	6/14	6/14	6/14	6/14	6/14		

N26.24712
W080.08522

N26.24752
W080.08521

CM

Open Beach Hatchery 2005

BP3

Zone=R31

N26.24041
W080.08730

N26.24061
W080.08730

Row																															
																												N--->			
10																												FT590	FT589	FT591	FT594
																												8/8	8/8	8/8	8/8
9	P474	FT588	FT587	P475	FT493	P473	FT580	P472	P469	P467	P466	FT579	P465	FT581	FT580	P461	P464	FT576	P463	P462	FT576	FT572	FT574	FT575	FT573	P460	FT565	FT561	FT560	P447
	8/8	8/8	8/8	8/8	8/8	8/7	8/7	8/7	8/6	8/5	8/4	8/3	8/3	8/3	8/3	8/1	8/1	8/1	8/1	8/1	7/31	7/31	7/31	7/31	7/31	7/31	7/29	7/29	7/29	7/29
8	FT558	FT556	P448	FT562	FT564	FT563	P446	P449	FT550	FT551	FT547	FT549	FT548	FT553	P440	FT536	FT534	FT532	P435	FT537	FT531	P433	FT530	FT533	FT535	P434	FT538	P437	P436	P430
	7/29	7/29	7/29	7/29	7/29	7/29	7/29	7/29	7/27	7/27	7/27	7/27	7/27	7/27	7/27	7/25	7/25	7/25	7/25	7/25	7/25	7/25	7/25	7/25	7/25	7/25	7/25	7/25	7/25	7/25
7	P426	P427	FT520	FT517	FT518	P423	FT519	P422	P419	P420	P421	FT510	P409	FT511	P405	P396	FT497	FT499	FT498	FT495	FT501	FT496	FT500	P397	P394	FT486	FT485	FT481	FT480	FT479
	7/23	7/23	7/21	7/21	7/21	7/21	7/21	7/21	7/21	7/21	7/21	7/19	7/19	7/19	7/19	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/15	7/15	7/15	7/15	7/15
6	FT484	FT482	P389	P387	FT471	FT468	P379	P378	P377	P376	FT470	FT469	P370	FT454	FT458	FT460	FT457	FT452	FT453	FT459	P365	FT456	P371	P367	P369	P368	FT461	FT443	FT434	FT432
	7/15	7/15	7/15	7/15	7/13	7/13	7/13	7/13	7/13	7/13	7/13	7/13	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/11	7/9	7/7	7/7
5	P348	FT431	FT433	P347	P346	FT414	FT410	FT412	P335	FT418	FT417	FT413	P334	FT415	FT416	P332	FT411	P333	FT389	FT388	FT386	FT384	FT392	P325	FT391	P323	FT383	P324	FT393	FT385
	7/7	7/7	7/7	7/7	7/7	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3	7/3
4	FT390	FT378	P312	FT376	FT374	P313	FT377	FT372	FT375	FT373	FT352	FT349	FT351	FT346	FT347	FT353	P299	FT350	FT354	FT356	FT359	FT355	P303	P302	P304	P300	FT357	FT358	FT360	P301
	7/3	7/1	7/1	7/1	7/1	7/1	7/1	7/1	7/1	7/1	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29	6/29
3	FT348	FT334	FT335	FT332	FT333	P281	FT323	FT322	P280	P277	FT321	FT320	P282	FT324	P279	FT300	P268	P265	P260	FT302	FT301	FT303	P269	FT305	P207	FT304	P266	P271	P267	FT284
	6/29	6/27	6/27	6/27	6/27	6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/25	6/23	6/23	6/23	6/23	6/23	6/23	6/23	6/23	6/23	6/23	6/23	6/23	6/23	6/23	6/21
2	FT281	FT278	FT282	FT285	P249	FT289	FT280	FT287	P245	P246	P244	FT279	FT288	FT283	FT286	P248	P247	FT263	FT265	P233	P234	FT261	P235	P232	FT264	FT262	FT260	FT252	FT244	FT253
	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/21	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/18	6/17	6/17	6/17
1	P218	FT246	FT248	FT251	P212	P217	FT245	FT243	FT247	P215	FT249	FT252	FT250	P213	P214	P216	P204	FT231	P193	P200	P197	FT233	P196	P198	P199	FT230	FT232	FT236	FT235	FT234
	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/17	6/15	6/15	6/15	6/15	6/15	6/15	6/15	6/15	6/15	6/15	6/15	6/15	6/15

N26.24042
W080.08722

N26.24082
W080.08717

CM
EI

Open Beach Hatchery 2005

BJL

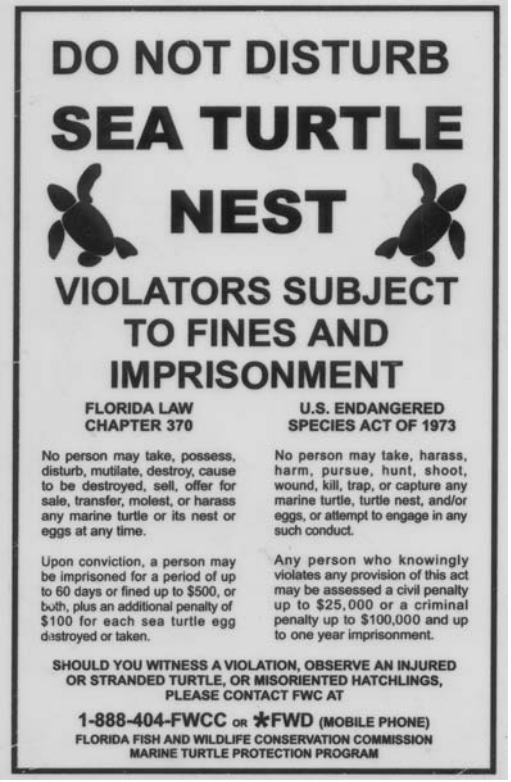
Park (W) N--->

Row																																				
2					103	102	100	101	97	99	91	92	90	89	88	87	80	78	79	77	76	75	74	73	72	71	70	69	68	66	67	65	64	62	63	61	59	60	58	55
					7/30	7/26	7/23	7/23	7/21	7/21	7/17	7/17	7/16	7/14	7/14	7/13	7/6	7/5	7/5	7/4	7/4	7/3	7/2	7/2	6/30	6/30	6/29	6/29	6/18	6/17	6/17	6/26	6/25	6/24	6/24	6/24	6/23	6/22	6/22	6/22
1	107	106	105	104	98	94	SKIP	96	93	95	86	85	84	86	82	81	57	56	54	53	52	51	50	49	48	47	45	44	42	43	40	41	38	39	37	36	35	32	31	34
	8/18	8/4	8/2	8/1	7/21	9/4		7/19	7/19	7/19	7/10	7/8	7/8	7/7	7/6	7/6	6/22	6/22	6/22	6/21	6/21	6/21	6/21	6/20	6/20	6/19	6/17	6/17	6/16	6/16	6/15	6/15	6/15	6/15	6/14	6/14	6/13	6/10	6/10	6/10

Ocean (E)

CM

Appendix 4: Sea turtle nest warning sign. Black lettering on yellow background. Actual size is 5.5" X 8.5".



Appendix 5: Sea Turtle Summary Report Forms.