

# CARETTA RESEARCH PROJECT

## ANNUAL REPORT – 2017 SEASON

### WASSAW NATIONAL WILDLIFE REFUGE, GA



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## 1. ABSTRACT

In 2017, the Caretta Research Project (CRP) recorded 253 nests and 199 false crawls from at least 126 individual loggerhead turtles, and three nests from at least one individual green turtle. The average clutch size was 110 eggs and the average incubation period was 56.6 days. Egg predation decreased compared to last year, with only 9 nests affected by raccoons and 1 by ghost crabs. Approximately 222 hatchlings were predated by raccoons and ants. Thirty-two nests were washed away during Hurricane Irma. The overall hatching success was 61% and 16,073 hatchlings emerged. Five assistants and 74 volunteers participated in data collection and fieldwork.

## 2. INTRODUCTION

The Caretta Research Project (CRP) is a non-profit environmental organization created for the conservation of loggerhead sea turtles in the Wassaw National Wildlife Refuge (WNWR). Founded in 1972 by the Savannah Science Museum, CRP is now in its 45th consecutive year of operation. The three goals of CRP are: (1) to monitor the long-term population trends and ecology of loggerheads in the WNWR, (2) to enhance the survival of eggs and hatchlings in an area where loss to predators and beach erosion are historically high, and (3) to educate and involve the public in research and conservation efforts. To date, CRP has recorded 1,698 individual turtles and successfully monitored 4,287 nests containing 489,866 eggs, ultimately releasing over 302,895 hatchlings. Additionally, CRP has involved over 3,000 volunteers in research and conservation.

## 3. METHODS AND MATERIALS

### 3.1 Nesting

#### 3.1.1. Beach patrols

Nightly patrols were conducted from 6 May to 8 August to document all nesting turtle activities on Wassaw Island. Two crews, each with one CRP staff member and up to 3 volunteers, systematically patrolled the beach between 9PM and 7AM using Kawasaki Mules. Patrol intervals varied throughout the night depending on tides, frequency of turtle activity, and weather conditions. If a turtle was encountered during a patrol, care was taken not to disturb the turtle. Vehicles and flashlights were kept off and CRP staff determined when crews could approach the turtle for data collection.

#### 3.1.2. False crawls and nests

All crawls were documented and examined for evidence of egg deposition. If laying was not observed and the presence of a body pit indicated the possibility of a nest, CRP staff initiated a search for the eggs. If no eggs were found, the event was recorded as a 'false crawl'. If laying was observed, a cord was placed in the nest to locate the eggs after the female returned to the ocean. For each crawl, information regarding date, time, and location were recorded. Locations were taken with respect to the nearest beach marker and by GPS position.

#### 3.1.3. Tagging

When encountered, each turtle was examined for and, if necessary, fitted with two external inconel tags and one internal Passive Integrated Transponder (PIT) tag. Inconel tags were located by visually inspecting both front flippers and PIT tags were located by scanning the front flippers using a Destron-EX pocket reader. If present, the tag numbers were recorded. If absent, inconel tags were applied to the first,

second or third proximal scute along the trailing edge of both front flippers and PIT tags were inserted subcutaneously at the elbow of the right front flipper. The PIT tag was scanned before and after application to ensure that it was functioning properly. All tag numbers and applicable data were sent to the University of Florida, Gainesville, for inclusion into the Archie Carr Center for Sea Turtle Research tagging database.

Tagging data was used to classify each turtle as a neophyte, remigrant, or immigrant. A neophyte is a turtle that has not previously been tagged (although she may have nested before). Tagging neophytes allows us to determine if the turtle is a remigrant or an immigrant during future nesting events. A remigrant is a turtle that was originally tagged on Wassaw Island and continues to use Wassaw during subsequent nesting attempts and nesting seasons. An immigrant is a turtle that was originally tagged on a different nesting beach, but was observed nesting or attempting to nest on Wassaw. Turtles with tag scars and no PIT tag could not be classified.

#### *3.1.4. Morphometrics*

For each turtle, curved carapace length (CCL) and width (CCW) were measured using a flexible, fiberglass measuring tape. CCL was measured medially from the inner nuchal notch (anteriorly) to the longest pygal tip (posteriorly) and CCW was measured at the maximum carapace width. Head width was also measured to the nearest millimeter at the widest part of the head (likely at the squamosal bones, posterior to the eyes) using calipers.

#### *3.1.5. Nest relocation*

Nests deposited above the spring tide line were left *in situ*. Nests deposited at or below the spring high tide line were relocated within six hours of deposition. When relocated, eggs were carefully excavated, counted, and placed in a 5-gallon bucket. Eggs broken by the female turtle or by CRP staff were documented and discarded. At the base of the adjacent dune, a new egg chamber was dug by hand to replicate the size, shape, and depth of the original nest. Eggs were carefully transferred into the new nest and reburied. The locations of both *in situ* and relocated nest sites were recorded.

#### *3.1.6. Nest protection*

After egg deposition or relocation, two types of protective screening were placed over all nests: (1) 1.5' X 1.5' metal screen with 0.4" x 0.4" mesh and (2) 5' X 4' plastic screen with 2" X 3" mesh. Screens were secured in place by pencil rods anchored at each corner of the larger screen. Reflective markers identified the nest locations and plastic labels identified the nest number. Smaller screens were removed and replaced with 0.4" x 0.4" mesh cones at 45 days of incubation in anticipation of hatching emergence. Nests were monitored throughout the season for evidence of predation, tidal wash and beach erosion. We continued to test the effectiveness of a new style of nest protection, plastic columns. After egg deposition or relocation, 8' X 4' plastic screens with 2" x 3" mesh were rolled into a column (~2.5' diameter) and placed erect over the clutch. Columns were secured by burying the bottom 8-10" of the column under sand and anchoring with four pencil rods. The opening at the top was zip tied together.

## **3.2. Hatching**

### *3.2.1. Beach patrols*

Dawn and dusk patrols were conducted from 14 June to 2 September to monitor nests for signs of hatchling emergence and predation. Upon observing the first signs of hatchling emergence (e.g. distinct depressions, empty eggshells in nest, hatching tracks, or live hatchlings), we recorded the date and allowed time for secondary emergences. Nests that showed signs of ant infestation were inventoried

immediately. Nests that were either fully or partially predated by raccoons or foxes were recorded and the extent of predation was estimated by counting eggshells scattered around the nest.

### *3.2.2. Nest inventories*

All nests were inventoried within 5 days of emergence or after 70 days of incubation for nests in which hatchling emergence was never observed. Nest inventories involved excavating all nest contents, then counting the number of live and dead hatchlings, empty eggshells, and unhatched eggs. Live hatchlings found at night were immediately released to crawl to the ocean, while live hatchlings found during the day were retained and released the following night. Live unhatched or pipped eggs were retained until subsequent emergence and release. All unhatched eggs were dissected to determine the percentage of embryonic development that was completed prior to termination.

Nest inventories were conducted to quantify the hatching and emergence success of each nest. Hatching success was calculated by dividing the number of hatched eggs by the total number of eggs in each nest (multiplied by 100). For nests with known clutch sizes, the number of hatched eggs was determined by subtracting the number of unhatched eggs (including dead pipped eggs) from the total number of eggs. For nests with unknown clutch sizes, the number of hatched eggs was estimated by counting the eggshells (fragment size 50% or greater) found in the nest, while the total number of eggs was determined by adding the number of eggshells and the number of unhatched eggs. Emergence Success was calculated by subtracting the number of dead hatchlings found within the nest and those pulled out of the nest by predators from the number of hatched eggs, then dividing by the total number of eggs (multiplied by 100). Incubation periods of each nest were determined based on the number of days between egg deposition and first hatchling emergence.

## **3.3. Strandings**

All turtles (dead or alive) found stranded on Wassaw Island were photographed and reported to the Sea Turtle Stranding and Salvage Network (STSSN) based in Miami, FL. We reported the species, location, size (CCL, CCW, straight CL, and straight CW), condition, and probable cause of death (estimated via necropsy by CRP staff). After examination, a large red “X” was spray-painted on the carapace of the turtle before moving it into the dunes. Complete reports were forwarded to the Georgia Department of Natural Resources.

## **3.4. Additional procedures – Collaborations**

### *3.4.1. Warnell School of Forestry and Natural Resources, University of Georgia – Dr. Brian Shamblin*

For the 11<sup>th</sup> year, we collected skin biopsies and eggshell samples from each female and each nest, respectively. Skin biopsies were collected between the neck and right front flipper using a 6mm biopsy punch and placed in 95% ethanol. The eggshell from one egg in each nest was collected and placed in 95% ethanol.

### *3.4.2. Archie Carr Center for Sea Turtle Research, University of Florida – Dr. Hannah Vander Zanden*

Additional skin biopsies were collected from nesting females using the same methodology as above.

### *3.4.3. Department of Biology, Georgia Southern University – Dr. David Rostal*

Dataloggers were placed in a total of 30 nests (10 early, 10 mid and 10 late) to estimate sex ratios of hatchlings produced on Wassaw Island.

### *3.4.4. Department of Biology, Armstrong State University - Dr. Kathryn Craven*

Fresh eggs were caught during deposition using sterile gloves and placed into bags and frozen.

3.4.5. Entomology Department, University of Georgia - Charlie Braman (MS student)

Ants were collected and preserved during ant predation and scavenging events, and nest characteristics were measured.

## 4. RESULTS

### 4.1. Loggerhead nesting

#### 4.1.1. False crawls and nests

We recorded 253 nests and 199 false crawls. The first nest was deposited on 3 May and the last on August 23. Nesting activity peaked in June (Fig. 1) and was distributed across the island (Fig. 2). Of the 253 nests, 164 were left *in situ* (64.8%) and 89 were relocated (35.2%) (Appendix C). Crawl success was 56.26%.

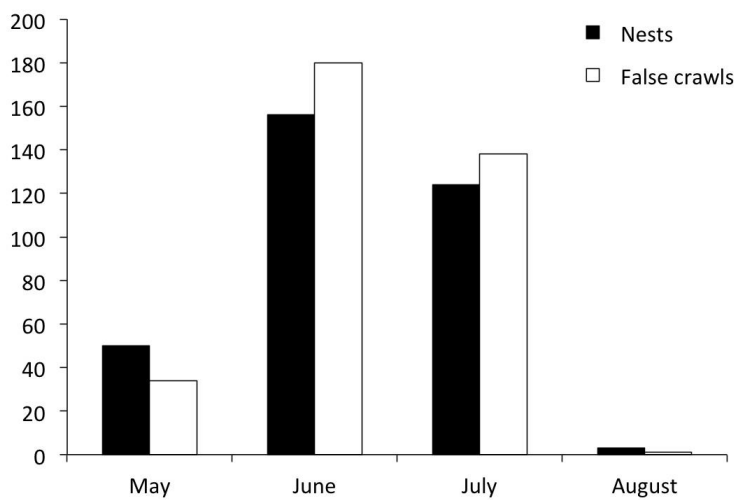


Figure 1. Histogram showing the monthly distribution of nests and false crawls on Wassaw Island.

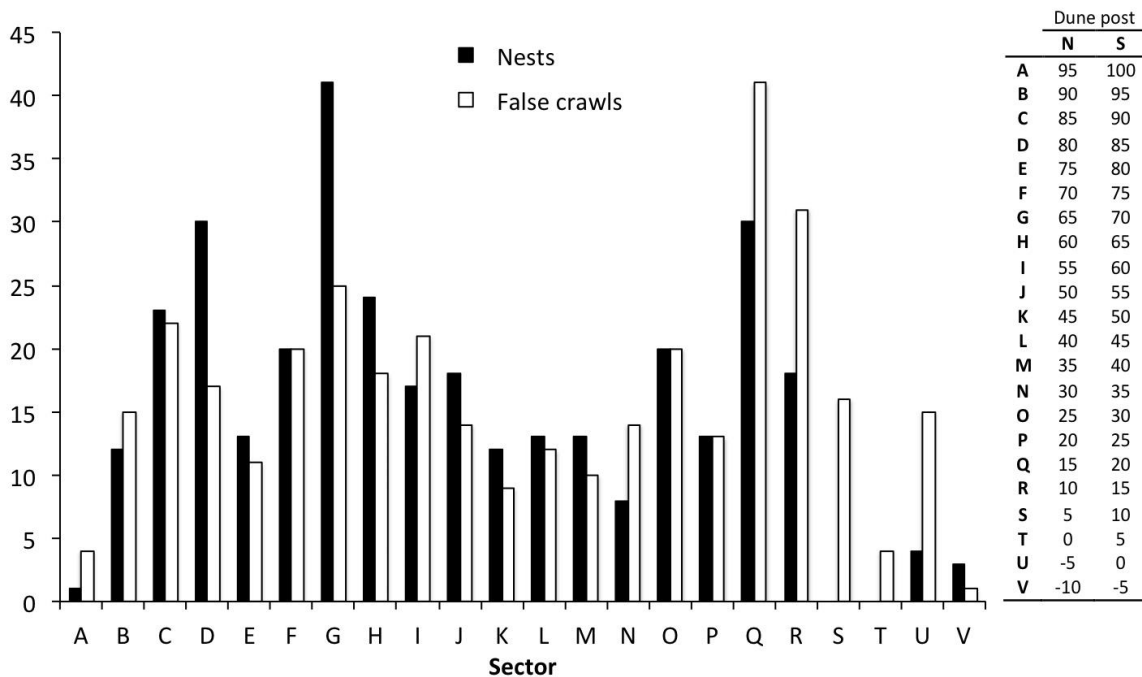


Figure 2. Histogram showing the distribution of loggerhead nests and false crawls on Wassaw Island. Letters correspond to the sectors of the beach between each U.S. Fish & Wildlife sign located at every five dune posts.

#### 4.1.2. Individual loggerhead turtles

We recorded 126 individual loggerheads: 78 neophytes (61.9%), 42 remigrants (33.3%), and five immigrants (4.0%), one scarred (.8%) (Appendix A). Six remigrant turtles were identified solely by their PIT tags.

Of the 253 loggerhead nests, 124 (49.0%) were deposited by 41 remigrants (including scarred), 102 (40.3%) were deposited by 65 neophytes, 5 (2.0%) were deposited by 4 immigrants, and 22 (7.9%) were deposited by females that were not observed nesting (i.e. ‘missed nests’). We recorded 16 turtles that were not observed depositing a nest (false crawls only) and 62 turtles that deposited only one nest. Forty-eight turtles deposited more than one nest, resulting in a mean clutch frequency of 3.5 nests per female (range=2-7 nests). The observed interesting interval for these females ranged from 11-49 days, with a mean interval of 16.9 days.

Of the 42 remigrants recorded, 12 were recorded on Wassaw Island in one previous season, 15 in two previous seasons, nine in three previous seasons, one in five previous seasons, one in six previous seasons, three in seven previous seasons and one in eight previous seasons. The mean remigration interval was 3.6 years (range=1-19 years). The female who has been nesting for eight previous seasons was first tagged on Wassaw in 1999. Since then, she has deposited 42 nests containing nearly 5,500 eggs, releasing more than 3,600 hatchlings into the ocean.

One turtle originally tagged on Wassaw Island was seen crawling on Kiawah Island this year. She was originally tagged as a neophyte in 2011 and had not been seen since. Additionally, three turtles originally tagged on Jekyll were seen nesting on Wassaw this year.

#### 4.2. Loggerhead hatching

#### 4.2.1. Nests and eggs

Within 229/253 nests, we recorded approximately 25,248 eggs. The mean clutch size was 110 eggs per nest (range=13-167 eggs per nest;  $N=229$ ) (Appendix C). The overall mean hatching success was 61.0% (range=0-99.0%;  $N=247$  nests). The mean hatching success was 56.0% for *in situ* nests (range=0-99.0%;  $N=160$  nests) and 70.4% for relocated nests (range=0-97.1%;  $N=87$  nests). The mean emergence rate was 63.7%. Overall mean incubation time was 56.6 days (range=49-72 days;  $N=155$  nests). The mean incubation period was 59.6 days for *in situ* nests (range=51-72 days;  $N=91$  nests) and 57.2 days for relocated nests (range=49-69;  $N=64$  nests).

#### 4.2.2. Nest and egg loss

Thirty-two nests were completely lost to tidal inundation during Hurricane Irma. Overall, clutch size was not known for 19 of the lost nests. Fifty-three nests were partially affected by tidal inundation. Nine nests were affected by predators: one by a fox (unknown number of eggs), seven by raccoons (unknown number of eggs and 176 hatchlings) and one by ghost crabs (two eggs). Two hundred and sixteen hatchlings were also predated by raccoons (176) and ants (39). Additional predation of hatchlings after emergence by foxes and raccoons was observed on numerous occasions throughout the season, but the extent of post-emergence predation is unquantifiable. No eggs were lost to human tampering.

Twenty-three broken eggs were encountered this season: eight were broken by turtles while covering their nests and 15 were broken by CRP staff while probing for eggs. An additional 262 eggs were collected for collaborative research studies (see Collaborations section).

### 4.4. Strandings

Two Kemp's ridley sea turtles and one loggerhead sea turtle were found stranded on Wassaw Island this year between May 6-September 2.

### 4.5. Collaborations

#### 4.5.1. Warnell School of Forestry and Natural Resources, University of Georgia – Dr. Brian Shamblin

We collected skin biopsies from 122 individual loggerheads and one egg from each of 252 nests. These samples will be used to assess the genetic population structure of the loggerhead nesting population in the southeastern US. In addition, DNA extracted from the eggshells of missed nests can be used to match those nests with previously sampled females.

#### 4.5.2. Archie Carr Center for Sea Turtle Research, University of Florida – Dr. Hannah Vander Zanden

We collected skin biopsies from 122 individual loggerheads. These samples will be used in stable isotope analyses to determine the foraging strategies of nesting loggerheads.

#### 4.5.3. Department of Biology, Georgia Southern University – Dr. David Rostal

Temperature data was collected from 30 nests to estimate hatchling sex ratios.

#### 4.5.4. Department of Biology, Armstrong State University - Dr. Kathryn Craven

Ten eggs were collected from nests to further determine the species of fungus and bacteria that affect hatching success in loggerhead nests.

#### 4.5.5. Entomology Department, University of Georgia - Charlie Braman (MS student)

Ants were collected and preserved from 10 nests.

## 5. ACKNOWLEDGEMENTS

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**APPENDIX A – 2017 INDIVIDUAL TURTLES**

<b>TURTLE #</b>	<b>STATUS</b>	<b>NEO #</b>	<b>RF TAG</b>	<b>RF #</b>	<b>LF TAG</b>	<b>LF #</b>	<b>PIT TAG</b>	<b>PIT TAG #</b>	<b>NOTES</b>
1	REMIGRANT		OLD	LLZ 768	OLD	YYZ 506	OLD	407B4C2373	DAWN
2	NEOPHYTE	1	NEW	LLZ 882	NEW	BBN 182	NEW	982.000406135004	
3	REMIGRANT		OLD	BBN 064	OLD	BBN 143	OLD	982.000163663287	
4	REMIGRANT		OLD	EEZ 676	OLD	EEK 893	OLD	989.001001238109	
5	REMIGRANT		OLD	BBN 015	OLD	BBN 248	OLD	982.000163682669	
6	REMIGRANT		OLD	LLM 860			OLD	407C51796A / 407B320C1D	CONSTANCE
7	REMIGRANT		NEW	LLZ 899	OLD	YYP 891	OLD	982.000163695070	TIAMAT
8	NEOPHYTE	2	NEW	LLZ 752	NEW	LLZ 773	NEW	982.000406134834	
9	REMIGRANT		OLD	YYZ 600	OLD	SSX 561	OLD	407C626079	AGENT 99
10	REMIGRANT		NEW	LLZ 763			OLD	0001DAD757 / 44132F1B36	LUNA
11	REMIGRANT		NEW	LLZ 736	NEW	LLZ 728	OLD	44140B642D	COLBY
12	REMIGRANT		NEW	LLZ 764	NEW	LLZ 732	NEW	407B402A4D	SWEET CHEEKS
13	REMIGRANT		OLD	TTG 505	OLD	TTG 519	OLD	4527260A41	
14	REMIGRANT				OLD	YYZ 303	OLD	4B121D1A2D	
15	REMIGRANT		NEW	LLZ 758	NEW	LLZ 738	OLD	982.000163683307	MALALA
16	REMIGRANT		OLD	EEZ 615	NEW	LLZ 737	OLD	989.001001239195	
17	NEOPHYTE	3	NEW	LLZ 742	NEW	LLZ 729	NEW	982.000406134875	
18	REMIGRANT		OLD	SSX 435	OLD	BBN 069	OLD	407B31242B	NERITINA
19	REMIGRANT		OLD	YYZ 443	OLD	LLZ 733	OLD	4466520F33	QUEENIE
20	NEOPHYTE	4	NEW	LLZ 761	NEW	LLZ 740	NEW	982.000406092436	
21	NEOPHYTE	5	NEW	LLZ 836	NEW	LLZ 838	NEW	982.000402272382 / 982.000406132758	
22	NEOPHYTE	6	NEW	LLZ 749	NEW	LLZ 747			
23	REMIGRANT		NEW	LLZ 777	OLD	BBN 244	OLD	982.000153646720	
24	NEOPHYTE	7	NEW	LLZ 827	NEW	LLZ 898	NEW	982.000402171776	
25	REMIGRANT		OLD	EEK 784	NEW	LLZ 833	OLD	989.001001238023 / 982.000163648904	
26	NEOPHYTE	8	NEW	LLZ 791	NEW	LLZ 782	NEW	982.000402168527	
27	REMIGRANT		OLD	EEZ 507	NEW	LLZ 746	OLD	989.001001239176	
28	NEOPHYTE	9	NEW	LLZ 884	NEW	LLZ 719	NEW	982.000402170201	
29	REMIGRANT		OLD	EEZ 644	OLD	EEZ 502	OLD	989.001001238136	
30	NEOPHYTE	10	NEW	LLZ 832	NEW	LLZ 743	NEW	982.000406131126	
31	NEOPHYTE	11	NEW	LLZ 835	NEW	LLZ 727	NEW	982.000406135139	
32	REMIGRANT		OLD	EEZ 580	NEW	LLZ 826	OLD	407B396308	
33	REMIGRANT		OLD	EEZ 659	NEW	LLZ 755	OLD	472C5A1632	
34	REMIGRANT		OLD	SSX 406	NEW	LLZ 723	OLD	44685E2A73	
35	REMIGRANT		NEW	LLZ 744	NEW	LLZ 770	OLD	4414780729	WIM-Y
36	REMIGRANT		OLD	YYZ 352	OLD	EEZ 577	OLD	4A1B0B2F60	
37	NEOPHYTE	12	NEW	LLZ 830	NEW	LLZ 730	NEW	982.000406130666	
38	REMIGRANT		OLD	SSX 391	OLD	SSX 360	OLD	436A0D1C1B	
39	REMIGRANT		NEW	LLZ 710	OLD	SSX 797	OLD	989.001001238014	
40	NEOPHYTE	13	NEW	LLZ 706	NEW	BBN 025	NEW	982.000406093026	
41	NEOPHYTE	14	NEW	LLZ 762	NEW	LLZ 741	NEW	982.000402171494	
42	NEOPHYTE	15	NEW	LLZ 837	NEW	LLZ 726	NEW	982.000406134986	
43	NEOPHYTE	16	NEW	LLZ 831	NEW	LLZ 834	NEW	982.000406135353	
44	NEOPHYTE	17	NEW	LLZ 840	NEW	LLZ 739	NEW	982.000406130535	
45	REMIGRANT		NEW	MMK 831	OLD	BBN 222	OLD	4B1125664A	
46	NEOPHYTE	18	NEW	LLZ 724	NEW	LLZ 709	NEW	982.000406134872	
47	NEOPHYTE	19	NEW	MMK 836	NEW	LLZ 842	NEW	982.000406130717	
48	NEOPHYTE	20	NEW	LLZ 841	NEW	LLZ 745	NEW	982.000406048957	
49	NEOPHYTE	21	NEW	LLZ 767	NEW	LLZ 757	NEW	982.000406131266	
50	NEOPHYTE	22	NEW	LLZ 796	NEW	LLZ 720	NEW	982.000402168705	

51	NEOPHYTE	23	NEW	MMK 828	NEW	MMK 837	NEW	982.000406130860	
52	NEOPHYTE	24	NEW	LLZ 895	NEW	MMK 832	NEW	982.000406048685	
53	REMIGRANT		OLD	EEZ 578	OLD	EEZ 601	OLD	989.001001238029	
54	NEOPHYTE	25	NEW	MMK 834	NEW	MMK 872	NEW	982.000406128359	
55	REMIGRANT		OLD	EEK 777	NEW	MMK 824	OLD	982.000163687429	
56	NEOPHYTE	26	NEW	MMK 827	NEW	MMK 835	NEW	982.000406130843	
57	REMIGRANT		OLD	EEK 738	OLD	EEK 744	OLD	982.000163676924	
58	NEOPHYTE	27	NEW	MMK 828	NEW	LLZ 829	NEW	982.000406130692	
59	REMIGRANT		OLD	EEZ 582	NEW	LLZ 722	OLD	982.000364295443	
60	NEOPHYTE	28	NEW	LLZ 713	NEW	LLZ 780	NEW	982.000402272397 / 982.000406132707	
61	REMIGRANT		NEW	MMK 820	OLD	EEZ 536	OLD	982.000364217169	
62	NEOPHYTE	29	NEW	MMK 875	NEW	MMK 842	NEW	982.000406131101	
63	NEOPHYTE	30	NEW	MMK 873	NEW	MMK 870	NEW	982.000406130942	CONNIE
64	NEOPHYTE	31	NEW	MMK 874	NEW	MMK 823	NEW	982.000406131167	
65	REMIGRANT		OLD	BBN 271	OLD	YYZ 449	OLD	982.000163656929	
66	NEOPHYTE	32	NEW	LLZ 701	NEW	LLZ 714	NEW	982.000406134889	
67	NEOPHYTE	33	NEW	MMK 669			NEW	982.000406128024	
68	REMIGRANT		OLD	BBN 004	NEW	LLZ 705	OLD	982.000163661675	
69	NEOPHYTE	34	NEW	LLZ 716	NEW	LLZ 704	NEW	982.000406127835	
70	NEOPHYTE	35	NEW	LLZ 725	NEW	MMK 869	NEW	982.000406130580	
71	REMIGRANT		OLD	EEZ 544	OLD	SSX 737	NEW	982.000406092680	
72	IMMIGRANT		OLD	UUF 100	OLD	UFF 099	OLD	985.121020797309	
73	NEOPHYTE	36	NEW	LLZ 708	NEW	LLZ 717	NEW	982.000406135309	
74	NEOPHYTE	37	NEW	MMK 822	NEW	MMK 668	NEW	982.000406131092	
75	NEOPHYTE	38	NEW	MMK 641	NEW	BBN 297	NEW	982.000406131128	
76	NEOPHYTE	39	NEW	MMK 673	new	MMK 670	NEW	982.000406131052	
77	REMIGRANT		OLD	EEK 814	OLD	EEZ 679	NEW	982.000406131755	
78	NEOPHYTE	40	NEW	LLZ 703	NEW	MMK 625	NEW	982.000406133132	
79	NEOPHYTE	41	NEW	MMK 647					
80	NEOPHYTE	42	NEW	MMK 644	NEW	MMK 646	NEW	982.000406131676	
81	NEOPHYTE	43	NEW	MMK 761	NEW	MMK 697	NEW	982.000406131780	
82	NEOPHYTE	44	NEW	MMK 687	NEW	MMK 643	NEW	982.000406132545	
83	IMMIGRANT		NEW	MMK 648	OLD	XXF 079	NEW	982.000406132440	
84	REMIGRANT		NEW	MMK 826	OLD	BBN 122	OLD	982.000163681296	
85	NEOPHYTE	45	NEW	LLZ 750	NEW	MMK 676	OLD	982.000406134798	
86	NEOPHYTE	46	NEW	MMK 650	NEW	MMK 691	NEW	982.000406133066	
87	NEOPHYTE	47	NEW	MMK 620	NEW	MMK 624	NEW	982.000406131260	
88	NEOPHYTE	48	NEW	MMK 843	NEW	MMK 841	NEW	982.000406133402	
89	NEOPHYTE	49					NEW	982.000406132553	
90	NEOPHYTE	50	NEW	MMK 645	NEW	MMK 677	NEW	982.000406132971	
91	NEOPHYTE	51	NEW	MMK 649	NEW	MMK 695	NEW	982.000406133006	
92	IMMIGRANT		OLD	YYZ 574	NEW	EEK 856	OLD	4B12291432	
93	REMIGRANT				NEW	MMK 675	OLD	407B636022	
94	REMIGRANT		OLD	LLM 876	OLD	EEZ 584	OLD	982.000364300432	
95	NEOPHYTE	52	NEW	LLZ 702	NEW	EEK 828	NEW	982.000406130672	
96	REMIGRANT		OLD	BBN 291	NEW	MMK 699	OLD	44127F7832	
97	NEOPHYTE	53	NEW	EEK 701	NEW	EEK 774	NEW	982.000406130851	
98	NEOPHYTE	54	NEW	EEK 848	NEW	LLZ 712	NEW	982.000406131182	
99	NEOPHYTE	55	NEW	EEK 854	NEW	LLZ 794	NEW	982.000406133377	
100	NEOPHYTE	56	NEW	EEK 835	NEW	EEK 859	NEW	982.000406132774	
101	NEOPHYTE	57	NEW	LLM 848	NEW	EEK 779	NEW	982.000406132772	
102	REMIGRANT		OLD	YYZ 368			OLD	4B11651F4A	
103	NEOPHYTE	58	NEW	EEK 829	NEW	LLZ 863	NEW	982.000402170836	
104	NEOPHYTE	59	NEW	EEK 826			NEW	982.000406133033	
105	NEOPHYTE	60	NEW	LLZ 748			NEW	982.000406133018	
106	NEOPHYTE	61	NEW	LLZ 778			NEW	982.000406132741	

107	SCARRED		NEW	YYZ 539	NEW	EEK 846	NEW	982.000402168938	
108	NEOPHYTE	62	NEW	MMK 656	NEW	EEK 855	NEW	982.000402172843	
109	NEOPHYTE	63	NEW	YYZ 488	NEW	MMK 663	NEW	982.000406131766	
110	NEOPHYTE	64	NEW	MMK 638	NEW	MMK 660	NEW	982.000406135135	
111	NEOPHYTE	65	NEW	MMK 628	NEW	MMK 622	NEW	982.000402172238	
112	NEOPHYTE	66	NEW	MMK 662	NEW	LLZ 889	NEW	982.000406132654	
113	NEOPHYTE	67	NEW	BBN 270			NEW	982.000402168516	
114	REMIGRANT		OLD	EEK 746			OLD	982.000163642193	
115	NEOPHYTE	68	NEW	LLZ 781			NEW	982.000402172011	
116	IMMIGRANT		OLD	MMM 424	OLD	MMM 425	NEW	982.000402272133 / 989.001005040677	
117	NEOPHYTE	69	NEW	MMK 661	NEW	MMK 626	NEW	982.000406133257	
118	NEOPHYTE	70	NEW	MMK 678	NEW	MMK 627	NEW	982.000402171466	
119	NEOPHYTE	71	NEW	MMM 927	NEW	EEK 780	NEW	982.000402171909	
120	NEOPHYTE	72	NEW	LLZ 892	NEW	LLZ 792	NEW	982.000402272343	
121	NEOPHYTE	73	NEW	LLZ 790	NEW	YYZ 482	NEW	982.000402168949	
122	NEOPHYTE	74					NEW	982.000402169999	
123	NEOPHYTE	75	NEW	MMK 696	NEW	MMK 672	NEW	982.000402171711	
124	NEOPHYTE	76	NEW	MMK 667	NEW	MMK 681	NEW	982.000402171670	GREEN TURTLE!
125	NEOPHYTE	77	NEW	MMK 623	NEW	MMK 821	NEW	982.000406132670	
126	NEOPHYTE	78	NEW	MMK 629	NEW	MMK 658	NEW	982.000402170334	
127	NEOPHYTE	79	NEW	MMK 657	NEW	MMK 664		982.000402169383	

## APPENDIX B

### Loggerhead Activity on Wassaw Island 1973-2017

\* Patrols did not cover the entire nesting season 1973-1977

\*\* Crawl Success=(# nests/# crawls)X100

\*\*\*One nest composed of 5 abnormal eggs is included

YEAR	TURTLES	NEOPHYTES	CRAWLS	NESTS	FALSE CRAWLS	**CRAWL SUCCESS (%)
1973*	25	25	82	35	47	42.68
1974*	49	46	116	61	55	52.59
1975*	40	36	135	56	79	41.48
1976*	47	40	157	51	106	32.48
1977*	44	38	247	76	171	30.77
1978	52	35	186	65	121	34.95
1979	56	34	160	55	105	34.38
1980	44	30	112	51	61	45.54
1981	54	36	163	75	88	46.01
1982	52	39	158	65	93	41.14
1983	49	34	133	61	72	45.86
1984	47	31	139	71	68	51.08
1985	60	46	116	66	50	56.90
1986	43	27	135	47	88	34.81
1987	23	18	55	23	32	41.82
1988	30	19	90	43	47	47.78
1989	35	20	126	43	83	34.13
1990	46	35	166	60	106	36.14
1991***	53	41	170	77	93	45.29
1992	52	38	140	80	60	57.14
1993	18	12	58	28	30	48.28
1994	55	38	185	105	80	56.76
1995	39	80	185	80	105	43.24
1996	63	40	230	135	95	58.70
1997	25	9	101	60	41	59.41
1998	42	20	118	69	49	58.47
1999	69	35	289	125	164	43.25
2000	60	41	143	82	61	57.34
2001	38	23	126	74	52	58.73
2002	38	22	91	56	35	61.54
2003	59	28	221	115	106	52.04
2004	20	12	71	37	34	52.11
2005	65	31	233	104	129	44.64
2006	60	29	266	141	125	53.01
2007	43	25	202	63	139	31.19
2008	70	36	275	120	155	43.64
2009	63	36	234	91	143	38.89
2010	86	50	352	159	193	45.17
2011	93	61	323	165	158	50.62
2012	101	68	541	138	403	25.51
2013	112	66	452	250	202	55.31
2014	51	31	193	122	71	63.21
2015	111	75	418	218	200	52.15
2016	155	83	686	333	353	48.54
<b>2017</b>	<b>127</b>	<b>79</b>	<b>455</b>	<b>256</b>	<b>199</b>	<b>56.26</b>
<b>TOTAL</b>	<b>2,564</b>	<b>1,698</b>	<b>9,234</b>	<b>4,287</b>	<b>4,947</b>	<b>46.91%</b>

## APPENDIX C: 2017 Nest Summary for Wassaw Island

NEST #	NEST LOCATION	INC (DAYS)	# EGGS	HATCHED	SUCCESS	NOTES
1	In situ	72	115	99	86.09%	
2	In situ	66	120	110	91.67%	
3	In situ		134	120	89.55%	
4	In situ	65	104	97	93.27%	
5	In situ	66	128	32	25.00%	Washed over
6	In situ	64	139	49	35.25%	Washed over 3X
7	In situ	64	112	96	85.71%	Queenie
8	In situ	64	146	141	96.58%	
9	Relocated	60	167	150	89.82%	
10	In situ	68	121	115	95.04%	
11	In situ	59	132	119	90.15%	
12	In situ	65	144	136	94.44%	
13	Relocated	63	109	99	90.83%	Dawn
14	In situ	66	140	132	94.29%	Agent 99
15	In situ	66	144	38	26.39%	Washed over 3X
16	Relocated	58	116	88	75.86%	
17	In situ	62	118	109	92.37%	Raccoon predation
18	In situ	60	108	104	96.30%	
19	In situ	65	103	80	77.67%	Washed over 2X
20	In situ	69	82	79	96.34%	Netrina
21	In situ	64	80	62	77.50%	Washed over 2X
22	In situ	58	100	53	53.00%	
23	Relocated	67	137	91	66.42%	
24	Relocated	64	146	115	78.77%	
25	Relocated		125	107	85.60%	Constance / Raccoon Predation
26	In situ	63	102	94	92.16%	Malala
27	Relocated	64	125	112	89.60%	
28	Relocated	56	134	104	77.61%	
29	In situ	62	99	76	76.77%	Ghost crab predation
30	In situ		127	115	90.55%	Raccoon predation
31	Relocated	64	109	100	91.74%	
32	In situ		101	0	0.00%	Luna / Washed over 3X
33	Relocated	69	129	124	96.12%	
34	In situ		124	19	15.32%	
35	Relocated	62	159	148	93.08%	Washed over 6X
36	Relocated	63	121	91	75.21%	
37	In situ		82	0	0.00%	Washed over 8X
38	Relocated	65	117	70	59.83%	
39	In situ		139	134	96.40%	Queenie / Washed over 2X
40	Relocated	61	125	92	73.60%	
41	In situ	58	115	110	95.65%	
42	In situ	58	101	65	64.36%	Fire ant predation
43	In situ	56	136	119	87.50%	
44	In situ		48	46	95.83%	Agent 99
45	In situ	58	104	103	99.04%	
46	Relocated	60	146	138	94.52%	Raccoon predation
47	In situ	58	90	82	91.11%	
48	In situ	60	119	101	84.87%	Washed over 2X
49	In situ		129	9	6.98%	Washed over 1X
50	In situ		93	13	13.98%	Washed over 4X
51	In situ	63	118	108	91.53%	
52	In situ	63	104	102	98.08%	
53	In situ		129	6	4.65%	Washed over 4X
54	In situ		106	0	0.00%	Luna Washed over 3X
55	Relocated		122	108	88.52%	
56	Relocated	61	98	87	88.78%	Raccoon predation
57	In situ	62	111	109	98.20%	

58	Relocated	57	102	82	80.39%	WIM-Y / Raccoon predation
59	In situ	63	121	114	94.21%	Tiamat
60	Relocated		146	124	84.93%	Constance / Raccoon Predation
61	In situ	61	116	113	97.41%	WIM-Y
62	Relocated	61	116	99	85.34%	
63	Relocated	55	108	97	89.81%	
64	In situ	62	104	96	92.31%	
65	Relocated		94	83	88.30%	Raccoon predation
66	Relocated		127	108	85.04%	
67	In situ		90	0	0.00%	Raccoon predation
68	In situ	63	82	68	82.93%	Washed over 4X
69	In situ	61	115	2	1.74%	Washed over 3X
70	In situ	66	110	99	90.00%	
71	In situ	63	70	65	92.86%	
72	In situ	57	44	40	90.91%	
73	In situ		94	0	0.00%	Washed over 7X
74	In situ		103	0	0.00%	Washed over 3X
75	Relocated	63	104	90	86.54%	
76	Relocated	63	137	126	91.97%	
77	Relocated	57	66	57	86.36%	
78	Relocated	53	122	109	89.34%	
79	Relocated	58	108	102	94.44%	
80	In situ	62	109	35	32.11%	Washed over 2X
81	Relocated	60	122	100	81.97%	Constance
82	In situ		106	94	88.68%	
83	Relocated	57	143	86	60.14%	
84	In situ		102	0	0.00%	Washed over 4X
85	Relocated	57	130	126	96.92%	Malala
86	In situ	58	101	94	93.07%	Raccoon predation
87	Relocated	56	115	111	96.52%	
88	In situ	57	41	23	56.10%	
89	In situ	59	134	125	93.28%	
90	In situ	57	129	43	33.33%	Sweet Cheeks
91	In situ	56	99	80	80.81%	
92	Relocated	51	144	125	86.81%	Raccoon and fire ant predation
93	Relocated	50	114	89	78.07%	
94	Relocated	56	121	116	95.87%	
95	In situ	62	125	80	64.00%	
96	In situ		105	98	93.33%	Luna
97	In situ	54	108	97	89.81%	Tiamat
98	In situ		98	0	0.00%	Washed over 3X
99	Relocated	50	132	122	92.42%	
100	In situ	57	98	90	91.84%	Luna
101	In situ	60	125	120	96.00%	Malala
102	In situ	56	104	97	93.27%	Raccoon predation
103	In situ		120	113	94.17%	
104	Relocated		126	20	15.87%	Washed over 3X
105	In situ	55	118	102	86.44%	
106	Relocated	57	148	115	77.70%	Constance
107	Relocated	58	137	129	94.16%	Dawn
108	Relocated	57	139	96	69.06%	Tiamat
109	In situ	60	122	117	95.90%	
110	In situ	56	13	11	84.62%	
111	In situ	60	70	16	22.86%	Washed over 3X
112	Relocated	58	90	81	90.00%	Sweet Cheeks
113	Relocated	58	110	94	85.45%	
114	In situ	52	96	91	94.79%	Colby / Raccoon predation
115	Relocated	57	89	84	94.38%	Agent 99
116	Relocated	58	77	72	93.51%	
117	In situ	57	106	100	94.34%	
118	In situ	54	129	121	93.80%	Neritina

119	In situ		unknown		0.00%	Raccoon predation
120	Relocated	59	108	84	77.78%	
121	Relocated	51	109	93	85.32%	
122	In situ	63	132	31	23.48%	Washed over 2X
123	In situ	52	119	57	47.90%	Washed over 2X
124	Relocated	53	127	106	83.46%	
125	Relocated	58	133	90	67.67%	
126	In situ	61	98	92	93.88%	
127	Relocated	60	97	21	21.65%	
128	In situ		88	0	0.00%	Washed over 3X
129	Relocated	55	84	80	95.24%	
130	Relocated	59	107	94	87.85%	
131	In situ	59	132	94	71.21%	Queenie / Washed over 2X
132	In situ	57	95	94	98.95%	
133	In situ	63	114	0	0.00%	Washed over 5X
134	Relocated	56	131	103	78.63%	WIM-Y
135	In situ	63	133	14	10.53%	
136	Relocated	53	131	123	93.89%	Neritina
137	In situ		112	0	0.00%	Washed over 3X
138	In situ	62	85	51	60.00%	Washed over 1X
139	Relocated	54	120	23	19.17%	Dawn
140	In situ		111	0	0.00%	WIM-Y Washed over / 6X
141	Relocated	53	101	86	85.15%	Connie
142	In situ	57	118	116	98.31%	Washed over 1X
143	In situ		122	0	0.00%	Washed over 2X
144	Relocated	54	130	120	92.31%	
145	In situ		108	0	0.00%	Washed over 1X
146	In situ	56	90	33	36.67%	Agent 99 / Washed over 4X
147	In situ	59	124	116	93.55%	Luna
148	In situ	57	138	124	89.86%	
149	In situ		unknown	0	0.00%	Raccoon predation
150	Relocated	54	131	109	83.21%	
151	In situ		unknown	0	0.00%	Tiamat Raccoon predation
152	In situ	57	128	120	93.75%	
153	In situ	58	25	23	92.00%	
154	In situ	59	138	121	87.68%	Agent 99
155	In situ	60	109	104	95.41%	
156	In situ	56	121	116	95.87%	
157	In situ	53	92	86	93.48%	
158	In situ	55	88	76	86.36%	
159	Relocated	51	92	84	91.30%	
160	In situ	51	102	93	91.18%	
161	In situ		90	0	0.00%	
162	In situ	61	132	101	76.52%	Washed over 1X
163	Relocated	55	120	116	96.67%	
164	In situ	56	85	82	96.47%	
165	In situ	58	113	98	86.73%	
166	In situ	61	80	78	97.50%	
167	In situ		107	0	0.00%	Washed over 1X
168	In situ		unknown	0	0.00%	Raccoon predation
169	In situ	55	102	89	87.25%	
170	In situ		90	73	81.11%	Washed over 4X
171	In situ	56	123	108	87.80%	
172	Relocated	53	107	102	95.33%	
173	In situ	55	117	104	88.89%	
174	In situ		141	0	0.00%	
175	In situ	54	118	112	94.92%	
176	In situ	59	89	80	89.89%	
177	Relocated	56	121	95	78.51%	
178	In situ	51	125	100	80.00%	
179	In situ	61	82	79	96.34%	

180	Relocated	59	62	53	85.48%	
181	In situ	58	107	103	96.26%	Washed over 1X
182	In situ		128	116	90.63%	Washed over 3X
183	In situ	57	136	77	56.62%	Washed over 2X
184	In situ	58	117	111	94.87%	
185	In situ	59	117	115	98.29%	
186	In situ	56	160	154	96.25%	
187	Relocated	56	103	42	40.78%	
188	In situ		108	102	94.44%	
189	Relocated	56	100	89	89.00%	
190	Relocated	49	105	102	97.14%	
191	Relocated	56	123	116	94.31%	
192	Relocated	50	158	117	74.05%	
193	In situ		118	95	80.51%	
194	Relocated	50	129	109	84.50%	
195	Relocated		91	0	0.00%	Washed over 1X
196	In situ		122	0	0.00%	Washed over 3X
197	In situ		61	0	0.00%	Washed over 1X
198	Relocated	53	100	83	83.00%	
199	Relocated		135	119	88.15%	
200	Relocated		84		unknown	Post-hatch raccoon predation
201	In situ		114	44	38.60%	Washed over 2X
202	Relocated		90	0	0.00%	Washed over 2X
203	In situ		111	95	85.59%	
204	In situ		101	94	93.07%	
205	Relocated	54	105	91	86.67%	
206	In situ		116	0	0.00%	Washed over 2X
207	In situ		unknown		unknown	
208	Relocated		119	60	50.42%	Raccoon predation
209	Relocated		80	44	55.00%	
210	In situ		111	0	0.00%	Washed over 3X
211	In situ		unknown		unknown	Post-hatch raccoon predation / Washed over 3X
212	Relocated		132		unknown	Post-hatch predation
213	In situ		81	74	91.36%	
214	Relocated		138	107	77.54%	
215	In situ		unknown		unknown	
216	In situ		109	0	0.00%	
217	Relocated		71	0	0.00%	Washed over 3X
218	In situ		77		unknown	
219	In situ		86	76	88.37%	
220	In situ		90	87	96.67%	
221	Relocated		127	122	96.06%	
222	In situ		116	36	31.03%	Washed over 3X and raccoon predation
223	In situ		125	103	82.40%	
224	In situ		96		unknown	
225	In situ		unknown	0	0.00%	Nest lost - IRMA
226	In situ		unknown	0	0.00%	Nest lost - IRMA
227	Relocated		99	0	0.00%	Nest lost - IRMA
228	In situ		159	0	0.00%	Nest lost - IRMA
229	Relocated		92	0	0.00%	Nest lost - IRMA
230	In situ		93	0	0.00%	Nest lost - IRMA
231	Relocated		120	0	0.00%	Nest lost - IRMA
232	Relocated		98	0	0.00%	Nest lost - IRMA
233	In situ		unknown	0	0.00%	Nest lost - IRMA
234	In situ		unknown	0	0.00%	Nest lost - IRMA
235	In situ		unknown	0	0.00%	Nest lost - IRMA
236	Relocated		98	0	0.00%	Nest lost - IRMA
237	In situ		18	0	0.00%	Nest lost - IRMA
238	In situ		unknown	0	0.00%	Nest lost - IRMA
239	Relocated		90	0	0.00%	Nest lost - IRMA
240	In situ		unknown	0	0.00%	Nest lost - IRMA



241	In situ		unknown	0	0.00%	Nest lost - IRMA
242	In situ		unknown	0	0.00%	GREEN TURTLE / Nest lost - IRMA
243	In situ		unknown	0	0.00%	Nest lost - IRMA
244	In situ		unknown	0	0.00%	Nest lost - IRMA
245	In situ		unknown	0	0.00%	Nest lost - IRMA
246	Relocated		61	0	0.00%	Nest lost - IRMA
247	In situ		unknown	0	0.00%	Nest lost - IRMA
248	In situ		unknown	0	0.00%	Nest lost - IRMA
249	Relocated		87	0	0.00%	Nest lost - IRMA
250	In situ		unknown	0	0.00%	Nest lost - IRMA
251	In situ		unknown	0	0.00%	Nest lost - IRMA
252	In situ		unknown	0	0.00%	Nest lost - IRMA
253	In situ		unknown	0	0.00%	Nest lost - IRMA
254	In situ		unknown	0	0.00%	GREEN TURTLE / Nest lost - IRMA
255	Relocated		103	0	0.00%	Nest lost - IRMA
256	In situ		unknown	0	0.00%	GREEN TURTLE / Nest lost - IRMA