TERRAPIN MONITORING AT POPLAR ISLAND
2003

Final Report submitted to the
Army Corps of Engineers

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BACKGROUND

Poplar Island is a large-scale ecological restoration project that is using dredged material to reconstruct an eroded island in the Middle Chesapeake Bay. As recently as 100 years ago, the island was greater than 400 hectares and contained upland, mid- and low-level wetlands. During the past 100 years the island had eroded and only three, small (<4 hectares) islands remained. In a large-scale project, the Army Corps of Engineers and the Maryland Port Authority are rebuilding and restoring Poplar Island. A series of stone-covered dikes facing the windward shores prevent erosion. Dredged material from the Chesapeake Bay Channels and Delaware Canal approach will fill the areas within the dikes, ultimately restoring the island to a size similar to what existed over 100 years ago. The ultimate goal of the project is to rebuild and restore the habitat for the wildlife that once existed on Poplar Island.

One of the wildlife species targeted in the restoration project is the diamondback terrapin, *Malaclemys terrapin.* These emydid turtles were probably common in the Poplar Island archipelago. However, the persistent erosion of Poplar and nearby islands has greatly reduced the nesting and juvenile habitat. Thus, the local terrapin population in the archipelago may be below their former levels. As the island eroded, the habitat diminished, and terrapins likely declined due to emigration and the resulting reduction in nesting and recruitment. By rebuilding the island and providing nesting and juvenile habitat, terrapin populations in the islands and the surrounding wetlands could significantly increase and potentially be restored to their former levels. The restoration could ultimately provide the nesting and juvenile habitat that will provide the resources that would allow terrapin populations to grow. Nesting habitat includes accessible sandy areas that are above the mean high tide. Juvenile habitat includes the salt flats and fringe marsh common along the Chesapeake Bay shoreline.

The Poplar Island Environmental Restoration Project is a unique opportunity to understand how large-scale ecological restoration projects affect terrapin populations and turtle populations in general. In 2002, we initiated a long-term terrapin monitoring program that will track the changes in the Poplar Island terrapin population as the restoration project progresses. By monitoring the terrapin population on Poplar Island, resource managers can learn how creating new terrapin nesting and juvenile habitat affects this and other terrapin populations. This information will contribute to understanding the ecological quality of the restored habitat on Poplar Island, as well as understanding how terrapins respond to large-scale restoration projects.

In 2002, Ohio University terrapin researchers identified major terrapin nesting beaches at Poplar Island, quantified nest and hatching success rates, and marked and released over 500 hatchlings (Roosenburg and Allman, 2003). A continuing concern is that some nesting beaches are not located in close proximity to suitable hatchling and juvenile habitat, potentially resulting in reduced hatchling survivorship. In 2002, the research team released hatchlings in a small marsh habitat located between Coaches and Poplar islands. This was the only natural marsh habitat available to hatchling and juvenile terrapins on Poplar Island. It is unknown whether this small area can support a large hatchling and juvenile population. Therefore, the researchers released marked hatchlings colleted in the 2003 study in cell 4DX, a recently constructed demonstration marsh. Terrapin researchers will determine the suitability of hatchling habitat in cell 4DX by future surveys of marked individuals in the area. The objectives for the 2003 field season were to:

1) Identify locations of nests at known terrapin nesting sites,
2) Track all known nests to monitor hatching success,
3) Mark and release all hatchlings caught in the study area.

METHODS

Identification of terrapin nests: From June to September 2003, a MES intern and the Ohio University team daily surveyed the beaches in the notch area (near cell 4), areas between Coaches and Poplar Island (outside of cell 5), inside the harbor (cell 6) and the beach outside the dike in Poplar Harbor (before cell 3). Geographic positioning system (GPS) recorded nest position and survey flags identified the specific location.

Monitoring hatching success: Usually within a week of identifying a recently oviposited nest, researchers placed an aluminum ring around it to prevent emerging hatchlings from escaping. They also placed anti-predator cages over nests to prevent avian predators from preying on emerging hatchlings. Beginning in late July, the survey team checked ringed nests at least once daily for emerged hatchlings. If a hatchling had emerged, researchers took it to the MES trailer for processing.

To estimate hatching success and clutch size statistics, project team members excavated nests ten days after the last hatchling emerged. For each nest, they recorded the number of live hatchlings, dead hatchlings, and eggs that appeared to be incompletely developed. Additionally, they determined if the nest was still active – eggs that had appeared not to complete development. The study team allowed nests containing viable eggs or hatchlings that had not fully absorbed their yolk sac to continue to develop; however, team members removed fully developed hatchlings from nests.

In mid-September 2003, NOAA forecasted the approach of Tropical Storm Isabel to the Chesapeake Bay region. A 1.5-2.5-m storm surge threatened Poplar Island and vicinity, creating the potential for all terrapin nests at Poplar Island to be submerged. To mark and tag hatchlings that may have escaped from ringed nests during the storm surge, team members excavated a large number of nests (those that were suspected based on age to have live hatchlings, active nests with eggs that had not hatched were left *in situ*) and removed hatchlings in the days immediately preceding the storm. The storm surge submerged all nesting habitat on Poplar Island, and the storm destroyed or contributed to the loss of many of the remaining nest rings. After the storm, project members located some of these nests and replaced their rings. They excavated all remaining nests to verify that rings were in the proper locations. They also removed fully developed hatchlings remaining in the nests at this time.

Capture of hatchlings: Project team members collected hatchlings from ringed nests and from un-ringed nests discovered by hatchling emergence. Additionally, team members also found a small number of hatchlings on the beach, and these were collected and processed.

Measuring, tagging, and release of hatchlings: Scientists brought all hatchlings back to the MES trailer on Poplar Island where they held hatchlings in plastic containers with water until they were processed. Team members marked hatchlings by notching the 10th marginal scutes on both the right and left side establishing the ID 10R10L as the cohort mark for 2003. Researchers implanted individually marked binary coded wire tags (CWTs, Northwest Marine Technologies ®) in all hatchlings. The CWTs were placed subcutaneously in the right rear hind limb using a 25-gauge needle. The CWTs should have high retention rates (Roosenburg and Allman, 2003) and team members will be able to identify terrapins originating from Poplar Island for the lifetime of the turtle. Scientists detected tag presence or absence using Northwest Marine Technologies' V-Detector. They measured plastron length, carapace length, width, and height (± 0.1 mm) and weighed (± 0.01 g) all hatchlings. Additionally, they checked for anomalous scute patterns and other developmental irregularities. Following tagging and measuring, team members released hatchlings, with the exception of one individual, in 4DX. They released one hatchling in the north corner of the notch. We held many of the hatchlings for several days prior to release. On several of the releases, the researhers released several individuals simultaneously. They held over the winter eight hatchlings that emerged from a nest in late October. They released these hatchlings the following spring after they were processed.

All hatchling data were summarized and processed using Microsoft Excel®.

All protocols and animal use was approved through Institutional Animal Care and Uses Committee at Ohio University and a Scientific Collecting Permit issued to Willem M. Roosenburg from the Maryland Department on Natural Resources – Fisheries Division.

RESULTS

NEST AND HATCHLING SURVIVORSHIP

The project team found 63 terrapin nests on Poplar Island during the summer of 2003 (raw nest data provide in Table 2 of the Appendix). These nests were found in the notch, on the outside of cell 5 and cell 3 (Table 1, Figure 1). They did not find any nests in cell 6 during 2003. Forty-nine nests were discovered at the time of oviposition or shortly thereafter and were used to evaluate nest survivorship (Table 2). Of the 49 nests, 11 were washed away or partially washed away by Tropical Storm Isabel, 35 produced hatchlings, 1 produced no hatchlings and 7 had overwintering hatchlings. There were 5 potential nest sites that could not be located or did not contain evidence of eggs. These nests were not included in the summary statistics.

Table 1. Summary of the number, location and predation of diamondback terrapin nests discovered on Poplar Island during the summer of 2003.

Location	Nests Discovered at Oviposition	Nests Discovered by Hatchling Emergence	Depredated	Total
Coaches Beach	31	11	1	43
3D Beach	9	2	0	11
Inside Notch Beach	9	0	0	9
Total	49	13	1	63

Figure 1. Location of terrapins nests on Poplar Island Environmental Restoration Project found during the 2003 nesting season. Yellow dots are the locations of individual nests. Locations determined using GPS and GIS software ARCVIEW.

Table 2. Summary of nest survivorship and causes of mortality during the 2003 nesting season.

	Number	Percent of Total
Total Nests	49	
Lost/ Partially Lost in Hurricane	11	22%
Nests with Hatchlings	35	71%
Nests without Hatchlings	1	2%
Overwintering/ Partially Overwintering	7	14%

Thirty nests were studied sufficiently to determine egg survivorship (Table 3). We documented 354 hatchlings and evidence of 35 undeveloped eggs or dead hatchlings from the 30 nests. These data suggest that the average clutch size was 13.0 eggs per clutch and that eggs had an average hatching success rate of 91% with several nests having apparent 100% survivorship.

Table 3. Summary statistics of egg survivorship.

Nests	30
Total Number of Eggs	389
Total Number of Hatchlings	354
Hatchling Success	91%
Range	29-100%
Mean Clutch Size	13.0

HATCHLINGS

Project members captured three hundred and eighty-seven hatchlings on Poplar Island between August 1 and 22 October 2003 (Table 4). Ringed nests produced 377 hatchlings, 8 hatchlings were caught by hand, and 2 were discovered in nests that were identified by the hole left by previously emerged hatchlings. Project scientists located 13 nests by the emergence of hatchlings. This was possible at Poplar Island because the substrate is harder than the normal sand beaches on which terrapins usually nest. Hence, the emerging hatchlings left a distinct depression or an actual hole that led into the nest chamber.

Table 4. Summary statistics of the number of hatchlings caught using different techniques.

Technique	Number
Ringed Nets	377
Caught by Hand	8
Nest discovered by emerging hatchlings	2
Total	387

The mean Poplar Island hatchling measurements are summarized in Table 5 (raw data provided in Table 1 of Appendix). Hatchlings had a mean plastron length of 26.9 mm and a mean carapace length of 31.1 mm. The average weight of hatchlings was 7.5 g. Eighty-two hatchlings (22%) had shell scute pattern anomalies. The scute anomalies included extra marginal, vertebral, and pleural scutes.

Table 5. Summary statistics of terrapin size metrics taken from the 387 terrapins emerging from nests on Poplar Island.

	Plastron Length (mm)	**Carapace Length (mm)**	**Carapace Width (mm)**	**Height (mm)**	**Mass (g)**
Mean	26.9	31.1	27.5	15.7	7.5
Standard Deviation	1.5	1.5	1.4	0.8	1.0

OVERWINTERING

Seven nests remained after 12 October from which hatchlings had not emerged. Hatchlings remain in overwintering nests and emerge in the following spring. Project personnel could not relocate two of the overwintering nests on 22 April 2004. One nest was near the water's edge outside cell 5 and we were unable to locate the ring and nest markers. The ring and markers were lost, most likely during a storm that coincided with a high tide. The second nest was on the dike of cell five, where wind may have eroded sand around the ring and then blown the ring away. There also were signs of recent earth moving activity in the area where this nest was. One nest contained only eggs with partially developed, dead embryos. This nest was the last nest laid in early August and the embryos most likely died because they had not completed development before the onset of cold weather. Four of the nests contained dead hatchlings. In each case, the roots of grasses had grown around the head either suffocating or dehydrating the neonates and killing the hatchlings. Two nests produced one live hatchling each. One of these nests also had empty eggshells suggesting that some of the hatchlings had emerged in the fall. This was most likely the nest that produced 8 hatchlings on 22 October 2003. Although terrapin overwintering in the nest has always been suspected in Maryland, this represents the first documented case of successful overwintering.

CONCLUSIONS

The findings of the 2003 nesting season continue to support the assumption that portions of Poplar Island are excellent terrapin nesting habitat. The large number of nests discovered and the rate at which eggs developed into hatchlings are comparable to other nesting areas in the Chesapeake Bay. What makes Poplar Island such excellent terrapin nesting habitat is the absence of nest predators which results in high nest survivorship rates that are much greater than other nesting areas that have been studied. As observed in 2002 (Roosenburg and Allman, 2003), the survivorship of known nests was much higher than normally encountered for terrapins because of the lack of nest predators on the Poplar Island. Raccoons, foxes, and otters are known terrapin nest predators and contribute to low nest survivorship in areas where predators occur, sometimes depredating 95% of the nests (Roosenburg, 1994). Additionally, the lack of raccoons on Poplar Island minimized the risk to nesting females that also may be depredated by raccoons (Seigel, 1980; Roosenburg personal observation). Thus, the Poplar Island restoration project is successfully creating terrapin nesting habitat.

Project scientists believe that the amount of terrapin nesting on Poplar Island is increasing. This conclusion is based on the discovery of a comparable number of nests to 2002. However, the effort for finding nests during 2003 was reduced. During the peak June season, there were no surveys of the nesting areas for two weeks. Detailed nesting surveys during this period would have yielded a far greater number of nests. Because a barrier fence was built on the outside of the road around cell 5 to prevent terrapins from nesting inside the cell, no drift fence was constructed to catch hatchlings from unobserved nests. Therefore, the total number of hatchlings caught in 2003 was fewer than 2002. However, the number of hatchlings caught in nest rings during 2003 was similar to 2002. This is notable because Tropical Storm Isabel contributed to the loss of some nests.

As observed in summer 2002 (Roosenburg and Allman, 2003), terrapin nesting on the island occurred in those areas where terrapins could easily access potential nesting sites. The stone face of the retaining dike around Poplar is a barrier that prevents terrapins from accessing potential nesting sites on many parts of the island. As wetland cells are completed, and the exterior dikes are breached to provide water flow, terrapins are likely to follow and begin nesting on other parts of the island.

Loud heavy machinery is a conspicuous component of the Poplar Island landscape. Terrapins will abandon nesting when disturbed, resulting in incomplete nests (Roosenburg and Dunham, 1997). We found no evidence that construction activities disturbed nesting terrapins at the Island in 2003. This was most likely due to the absence of construction activity in cell 5 during the 2003 nesting season. Mean clutch size (13 eggs per nest, range = 7-20 eggs per nest) was normal for Chesapeake Bay terrapins (Roosenburg, unpublished data). However, in 2002, several nests had clutch sizes of fewer than five eggs, and mean clutch size was 11 eggs per nest (Roosenburg and Allman, 2003). Incomplete nests found in 2002 may have resulted from abandonment of nesting by disturbed females (Roosenburg and Allman, 2003). Construction activity may disturb terrapin nesting at Poplar Island when it occurs in close vicinity to nesting beaches. However, most heavy construction activity at Poplar occurs far from nesting beaches and does not seem to disturb nesting females.

Hatchling and juvenile terrapins require shallow marsh habitats. Currently, these habitats are limited on Poplar Island, and terrapin nesting beaches such as the beach outside of cell 3 are not located in close proximity to marsh habitat. Consequently, hatchlings from these areas may not have access to suitable hatchling and juvenile habitat, which may result in reduced hatchling survivorship. To mitigate this potential problem, and to evaluate the potential for the creation of marsh habitats for hatchling and juvenile terrapins, team members released hatchlings into cell 4DX, a newly-constructed demonstration marsh. Although not a mature marsh yet, cell 4DX supports fish and invertebrate populations that may serve as food sources for young terrapins. Future surveys of marked terrapins in cell 4DX will determine the suitability this habitat.

To mark and tag hatchlings that may have otherwise escaped from ringed nests during Tropical Storm Isabel and the associated storm surge, team members excavated a large number of nests and removed hatchlings in the days immediately preceding the storm. Therefore, they were unable to determine hatchling overwintering rates because some of the nests that they excavated may have otherwise overwintered. Additionally, our hatchling success estimates assume that all excavated hatchlings would have survived and emerged on their own. However, hatchlings may die before emerging from nests. Consequently, the researchers may have overestimated hatchling success. However, most hatchlings left in nests during Tropical Storm Isabel survived the inundation caused by the storm surge. The fact that most hatchlings that remained in the nest survived Tropical Storm Isabel indicates that the estimate of hatchling survivorship based on excavated nests prior to the storm is accurate.

The hatchlings produced on Poplar Island were similar in size and weight to those captured during previous studies in the Patuxent River in Maryland (Roosenburg, 1992). The frequency of shell scute anomalies, 22%, was higher than expected. High frequency of shell scute anomalies was also observed in 2002 (Roosenburg and Allman, 2003). Warmer incubation temperatures cause higher frequencies of shell scute anomalies in terrapins (Herlands et al., 2002). The high frequency of shell scute anomalies in Poplar hatchlings could be due, in part, to the limited vegetation on Poplar Island that could provide shaded, cooler incubation environments (Jeyasuria et al., 1995). Although shell anomalies have been associated with higher incubation temperatures, there is no evidence to suggest that these anomalies have any detrimental effects on terrapins or other turtle species. Shell anomalies occur at higher frequency in female terrapins than in males and may be linked to temperature-dependent sex determination (TSD). For terrapins, warmer incubation temperatures produce females, and cooler conditions produce males (Jeyasuria et al., 1995; Roosenburg and Kelly, 1996). The higher frequency of shell anamolies may be indirect evidence that Poplar Island may be producing a greater than normal number of female hatchlings. Continued monitoring of Poplar Island terrapins will be able to confirm this hypothesis.

The initial success of terrapin use of Poplar Island predicts the success that similar projects may have in creating terrapin nesting habitat. One of the major factors threatening terrapin populations throughout their range is the loss of nesting habitat to development and shoreline stabilization (Roosenburg, 1991; Siegel and Gibbons, 1995). Projects such as Poplar Island that combine the beneficial use of dredged material and ecological restoration have the potential to create habitat similar to what has been lost to erosion and human practices. With proper management, areas such as Poplar Island may become areas of concentration for species such as terrapins and thus become source populations for the recovery of terrapins throughout the Bay.

RECOMMENDATIONS

As the restoration project at Poplar Island continues, terrapins will continue to use the habitat for nesting. There are some short-term measures that can be taken to 1) prevent terrapins from entering cells under construction and 2) to improve nesting habitat on the island. First, the terrapin researchers recommend construction and/ or continued maintenance of fences around cells 4 and 5. The fences should prevent nesting females and hatchlings from crossing the road and entering the cells. This also will reduce the risk of terrapins being hit by construction equipment that uses these roads. Second, we suggest that in Spring 2004, after the last overwintering hatchlings have emerged, and before the nesting season begins, that additional sand be brought into areas, particularly along the outside of cell 3, to create more nesting habitat. This may be particularly appropriate for areas adjacent to the jetties that are proposed for the entrance to cell 3D and the Poplar Harbor area. Because terrapins avoid nesting in areas with dense vegetation (Roosenburg 1996), providing open, sandy areas on the seaward side of the dikes should reduce efforts by terrapins to enter into cells under construction to find suitable, open areas. Additionally, the sand could greatly improve the habitat along the outside dike of cell 3, where females frequently encounter rocks while trying to excavate a nesting cavity. Third, predator control on the island will be paramount to the continued success of terrapin recruitment. Keeping raccoon and fox populations to a minimum will maintain the high levels of nest survivorship observed in 2002 and 2003. Finally, efforts to promote the use of by-catch reduction devices (BRDs) on crab pots fished in and around Poplar Island archipelago will increase adult survivorship. Crab pots drown terrapins and can have dramatic effects on their populations (reviewed in Roosenburg 2004). Promoting or requiring the use of BRDs in the Poplar Island archipelago could greatly reduce the mortality of juvenile female and male terrapins. The recommendations offered herein will contribute to the continuing and increasing use of Poplar Island by terrapins. As terrapin monitoring continues, we will be able to evaluate the success of these measures if implemented.

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L02-04) issued to WMR. All collection of terrapins was covered under a Scientific Collecting Permit number 2003-51 issued to WMR through the Maryland Department of Natural Resources.

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Appendix: Table 1. 2003 Hatchlings sorted by date of emergence.

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
7/18/2003	41019		10R10L	hand	3D	30.2	33.7	29.3	16.7	8.81		yolk sack
8/19/2003	41023		10R10L	ring	7	27.6	29.9	26.7	16.5	7.42		tag in right hind leg, dug up for TV
8/21/2003	41032		10R10L	ring	7	27.8	31.3	26.6	15.8	7.67		
8/21/2003	41029		10R10L	ring	7	26.9	30.9	26.6	16.9	7.75	8.6	
8/21/2003	41027		10R10L	ring	7	28.9	31.8	26.8	15.9	7.81	8.4	
8/21/2003	41026		10R10L	ring	7	28.0	31.3	28.1	16.0	7.90	8.8	
8/22/2003	41031		10R10L	ring	7	27.1	31.2	28.4	15.6	8.06	8.6	
8/22/2003	41036		10R10L	ring	38	27.9	31.0	27.6	15.3	7.57	8.3	
8/24/2003	41049		10R10L	ring	16	27.3	30.0	27.5	16.1	8.42	8.6	
8/24/2003	41039		10R10L	ring	16	27.2	31.2	27.8	16.9	8.65	8.7	
8/24/2003	41047		10R10L	ring	16	28.2	31.7	28.0	16.9	8.91	8.8	
8/24/2003	41034		10R10L	ring	16	29.2	31.9	28.5	16.8	9.25	8.4	re-tagged with 41034, original tag (41042) did not scan
8/26/2003	41057		10R10L	hand	3D	30.8	31.7	29.1	16.8	9.48	8.8	anomalousalous left and right costals
8/26/2003	41060		10R10L	hand	3D	25.3	27.9	25.0	16.0	7.29	7.8	
8/26/2003	41021		10R10L	hand	3D	28.9	31.8	28.5	16.5	8.41	8.7	
8/27/2003	41054		10R10L	hand	63	24.5	28.9	27.1	16.6	6.58	8.7	
8/27/2003	41041		10R10L	hand	63	26.2	30.1	27.2	16.0	6.99	8.2	
8/27/2003	41062		10R10L	hand	3D	29.7	33.4	30.5	17.8	9.15	8.8	anomalousalous left costals
8/28/2003	41064		10R10L	hand	Coaches	26.5	29.2	26.9	16.6	6.69		anomalousalous V3-V4
9/4/2003	41067		10R10L	ring	2	28.2	31.3	28.5	17.1	9.02	8.5	
9/5/2003	41065		10R10L	hand	Coaches	28.6	31.7	28.7	16.3	7.98	8.7	
9/14/2003	41615		10R10L	ring	45	25.9	29.3	26.5	14.7	7.12	8.2	yolk sac
9/15/2003	41081	41082	10R10L	ring	1	25.2	28.3	25.7	14.5	6.60	8.5	26 marginals, anomalousalous V4-V5
9/15/2003	41075		10R10L	ring	1	27.5	31.1	27.7	15.2	6.79	9.0	26 marginals
9/15/2003	41069		10R10L	ring	1	27.7	31.9	28.7	15.6	7.38	8.7	26 marginals
9/15/2003	41088		10R10L	ring	1	28.0	31.7	28.6	15.1	7.53	9.0	26 marginals
9/15/2003	41078	41079	10R10L	ring	1	28.0	32.0	28.6	15.7	7.60	9.1	26 marginals
9/15/2003	41077		10R10L	ring	1	28.2	32.2	28.3	14.5	7.62	9.3	26 marginals
9/15/2003	41070		10R10L	ring	1	28.1	32.6	29.5	15.0	7.68	8.9	anomalousalous right and left costals
9/15/2003	41080		10R10L	ring	1	26.6	30.1	26.8	14.2	6.13	8.7	
9/15/2003	41073		10R10L	ring	1	29.1	32.5	29.1	14.6	7.46	8.6	
9/15/2003	41072		10R10L	ring	1	28.8	32.1	28.8	15.5	7.71	9.2	
9/15/2003	41087		10R10L	ring	3	26.6	30.5	27.6	15.0	6.79	8.8	anomalousalous V5, right and left costals
9/15/2003	41090		10R10L	ring	3	28.3	30.6	28.1	14.4	6.92	8.4	anomalous V5
9/15/2003	41091		10R10L	ring	3	28.3	30.4	27.8	14.6	7.21	8.6	anomalous V5
9/15/2003	41095		10R10L	ring	3	27.3	30.2	27.7	14.7	6.51	8.4	
9/15/2003	41098		10R10L	ring	3	27.5	31.2	27.9	14.7	6.84	8.5	
9/15/2003	41100		10R10L	ring	3	27.8	30.0	27.9	15.4	6.92	8.6	
9/15/2003	41103		10R10L	ring	3	27.6	30.3	28.3	14.7	6.94	8.7	
9/15/2003	41105		10R10L	ring	3	28.0	31.0	28.2	14.4	7.03	8.7	
9/15/2003	41101		10R10L	ring	3	28.4	31.5	28.6	15.0	7.06	8.8	
9/15/2003	41106		10R10L	ring	3	27.3	30.3	28.7	15.2	7.26	8.3	

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/15/2003	41093		10R10L	ring	3	29.5	33.5	28.8	15.6	8.46	8.9	
9/15/2003	41126		10R10L	ring	5	26.5	30.4	26.1	14.5	6.44	8.6	
9/15/2003	41120		10R10L	ring	5	24.8	30.1	27.1	15.0	6.67	8.5	
9/15/2003	41121		10R10L	ring	5	27.0	30.6	27.7	15.4	6.75		
9/15/2003	41116		10R10L	ring	5	26.5	29.9	27.6	15.7	6.91	8.7	
9/15/2003	41118		10R10L	ring	5	26.7	30.3	27.6	15.3	6.93	8.9	
9/15/2003			10R10L	ring	5	26.2	30.2	27.5	14.9	6.94	8.7	tagged, but did not record ID
9/15/2003	41123		10R10L	ring	5	27.1	30.6	26.8	15.1	7.00	8.7	
9/15/2003	41113		10R10L	ring	5	26.1	30.9	28.3	15.5	7.26	9.0	
9/15/2003	41131		10R10L	ring	14	25.6	29.6	25.8	15.0	6.26		anomalous V1-V3, V5
9/15/2003	41133		10R10L	ring	14	26.2	29.7	26.7	14.3	6.41	8.3	anomalous V5
9/15/2003	41145	41146	10R10L	ring	14	26.0	29.7	27.3	15.4	6.64		anomalous V5
9/15/2003	41124		10R10L	ring	14	27.1	30.6	27.0	15.3	6.79		anomalous V5
9/15/2003	41147	41148	10R10L	ring	14	26.5	28.9	26.7	15.8	6.80		anomalous PL scutes, gap between 12L+12R
9/15/2003	41142	41143	10R10L	ring	14	26.9	30.1	26.8	15.8	6.92		large 4th vertebral anomalous V5
9/15/2003	41129		10R10L	ring	14	27.4	31.0	27.9	15.2	6.96	8.4	anomalous right costals
9/15/2003	41144		10R10L	ring	14	27.2	29.7	25.5	15.7	6.55		
9/15/2003	41139		10R10L	ring	14	26.8	30.5	26.5	15.8	6.60		
9/15/2003	41149		10R10L	ring	14	25.6	29.8	26.5	15.2	6.65		
9/15/2003	41128		10R10L	ring	14	25.8	30.7	26.9	15.8	6.76		
9/15/2003	41134		10R10L	ring	14	27.3	30.8	27.6	15.1	6.79		
9/15/2003	41137	41138	10R10L	ring	14	26.8	30.7	27.4	14.9	6.86	8.6	large 4th vertebral
9/15/2003	41136		10R10L	ring	14	27.0	30.4	27.3	15.5	7.00		
9/15/2003	41108		10R10L	ring	37	27.5	29.1	27.4	15.1	6.52	8.5	
9/16/2003	41162		10R10L	ring	4	26.2	29.7	26.9	14.6	6.38		anomalous V5
9/16/2003	41166		10R10L	ring	4	25.5	29.7	26.1	14.3	6.46	8.6	anomalous V5
9/16/2003	41175	41176	10R10L	ring	4	27.7	30.0	27.1	14.7	6.52		anomalous V5
9/16/2003	41159		10R10L	ring	4	25.7	30.5	27.4	13.9	6.49		
9/16/2003	41179		10R10L	ring	4	24.5	29.2	26.6	14.3	5.94		
9/16/2003	41151		10R10L	ring	4	25.8	30.0	27.4	14.6	6.26		
9/16/2003	41177		10R10L	ring	4	25.4	29.5	26.5	14.9	6.30	8.4	
9/16/2003	41161	41160	10R10L	ring	4	26.7	30.8	26.3	14.1	6.33		
9/16/2003	41157		10R10L	ring	4	26.7	30.8	26.9	15.0	6.54		
9/16/2003	41174		10R10L	ring	4	26.9	30.3	27.3	14.8	6.57	8.5	
9/16/2003	41167		10R10L	ring	4	26.3	30.7	27.5	14.0	6.59		
9/16/2003	41164		10R10L	ring	4	27.9	31.0	26.4	15.1	6.63		
9/16/2003	41154		10R10L	ring	4	27.2	30.9	28.2	14.3	6.72		
9/16/2003	41152		10R10L	ring	4	27.8	31.0	27.7	15.0	6.79		
9/16/2003	41156		10R10L	ring	4	26.6	30.6	27.8	14.0	6.88		
9/16/2003	41172		10R10L	ring	4	26.6	31.2	27.9	15.3	7.04	8.8	
9/16/2003	41761		10R10L	ring	6	27.7	31.7	27.1	15.2	7.11	8.4	13 marginals on left
9/16/2003	41752		10R10L	ring	6	26.2	31.6	29.4	14.6	7.16	8.6	anomalous V5

Appendix: Table 1. 2003 Hatchlings sorted by date of emergence.

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/16/2003	41763	41764	10R10L	ring	6	28.3	32.3	29.4	15.5	8.06		anomalous V3-V5
9/16/2003	41768	41769	10R10L	ring	6	26.3	29.8	26.4	14.8	6.64	8.3	
9/16/2003	41737	41738	10R10L	ring	6	26.7	31.5	27.3	15.1	7.14	8.8	
9/16/2003	41755	41756	10R10L	ring	6	27.4	31.0	27.1	15.3	7.15		
9/16/2003	41757		10R10L	ring	6	26.8	31.1	28.5	15.1	7.33		
9/16/2003	41744		10R10L	ring	6	28.1	32.0	27.0	16.0	7.44		
9/16/2003	41767		10R10L	ring	6	27.1	31.1	26.2	15.8	7.49		
9/16/2003	41758	41759	10R10L	ring	6	27.3	32.1	28.6	15.1	7.53	8.6	
9/16/2003	41762		10R10L	ring	6	27.6	31.7	28.3	15.1	7.54		
9/16/2003	41750	41751	10R10L	ring	6	26.7	31.8	28.4	16.2	7.60		
9/16/2003	41734		10R10L	ring	6	27.6	32.3	27.6	16.1	7.64		
9/16/2003	41747		10R10L	ring	6	28.1	32.1	28.7	15.4	7.75		
9/16/2003	41742	41743	10R10L	ring	6	27.7	31.9	28.3	15.9	7.84		
9/16/2003	41753	41754	10R10L	ring	6	28.5	32.2	28.9	15.2	7.90		
9/16/2003	41765		10R10L	ring	6	28.0	32.6	29.1	15.4	8.24	8.7	
9/16/2003	41735	41736	10R10L	ring	6	28.7	32.6	29.4	16.0	8.43		
9/16/2003	41230		10R10L	ring	8	26.4	31.2	27.3	15.8	6.93		gap between L13 and R13, anomalous V4
9/16/2003	41225		10R10L	ring	8	27.0	32.5	28.2	16.8	7.38		anomalous V5, 26 marginals
9/16/2003	41233		10R10L	ring	8	26.0	30.4	27.7	15.7	7.00		
9/16/2003	41223		10R10L	ring	8	26.2	30.8	27.6	15.6	7.11		
9/16/2003	41236		10R10L	ring	8	27.4	31.5	27.8	16.2	7.23		
9/16/2003	41226	41227	10R10L	ring	8	27.1	31.4	28.2	15.8	7.36		
9/16/2003	41220		10R10L	ring	8	26.9	31.6	28.5	16.0	7.43		
9/16/2003	41238		10R10L	ring	8	28.1	32.1	28.1	16.1	7.43		
9/16/2003	41228		10R10L	ring	8	27.4	31.0	28.0	16.0	7.49		
9/16/2003	41221	41222	10R10L	ring	8	27.8	32.2	29.1	16.0	7.59		
9/16/2003	41231		10R10L	ring	8	27.1	32.4	28.5	15.9	7.80		
9/16/2003	41842	41843	10R10L	ring	11	28.0	32.2	29.2	15.4	7.91	8.6	anomalous V4-V5
9/16/2003	41856		10R10L	ring	11	27.1	31.1	28.4	15.9	7.95	8.5	anomalous V5
9/16/2003	41847	41848	10R10L	ring	11	27.1	31.7	29.7	15.4	8.22	8.8	anomalous V3-V5, saved
9/16/2003	41864		10R10L	ring	11	26.3	31.2	28.5	15.0	7.16		
9/16/2003	41854		10R10L	ring	11	27.6	31.3	28.9	16.1	7.51	8.7	
9/16/2003	41862		10R10L	ring	11	26.9	31.3	28.5	15.8	7.63		
9/16/2003	41859		10R10L	ring	11	26.8	31.0	28.8	15.2	7.64	8.5	
9/16/2003	41851		10R10L	ring	11	28.0	30.9	29.3	15.8	8.36	8.8	saved
9/16/2003	41382	41383	10R10L	ring	17	23.3	26.9	23.5	14.1	4.61		anomalous V4-V5, anomalous left costals
9/16/2003	41380	41381	10R10L	ring	17	24.5	27.7	24.2	14.5	5.24		anomalous V4-V5
9/16/2003	41371		10R10L	ring	17	24.8	27.7	25.3	14.5	5.33		anomalous V4-V5
9/16/2003	41375	41376	10R10L	ring	17	24.7	28.9	24.7	14.6	5.45		anomalous V5
9/16/2003	41359		10R10L	ring	17	23.5	28.2	25.7	13.6	5.49		anomalous V5
9/16/2003	41369		10R10L	ring	17	24.7	28.8	25.8	14.2	5.72		anomalous V5
9/16/2003	41351		10R10L	ring	17	24.6	29.2	25.6	14.3	5.79		anomalous V4-V5

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/16/2003	41364		10R10L	ring	17	25.3	29.1	26.7	14.4	5.79		anomalous V5
9/16/2003	41377	41378	10R10L	ring	17	24.7	28.5	24.4	14.9	5.83		anomalous V5
9/16/2003	41356		10R10L	ring	17	25.5	29.2	26.6	14.0	5.85		anomalous V4-V5
9/16/2003	41241		10R10L	ring	17	25.6	29.5	26.3	15.4	6.19		anomalous V5
9/16/2003	41379		10R10L	ring	17	24.7	28.8	24.8	14.4	5.46		
9/16/2003	41355		10R10L	ring	17	24.9	29.2	25.5	14.6	5.66		
9/16/2003	41374		10R10L	ring	17	24.8	28.7	25.6	14.7	5.71		
9/16/2003	41240		10R10L	ring	17	25.6	29.5	25.8	15.5	5.83		
9/16/2003	41366		10R10L	ring	17	24.8	29.2	25.8	15.3	5.87		
9/16/2003	41367	41368	10R10L	ring	17	26.1	29.9	26.5	14.6	6.09		
9/16/2003	41180	41181	10R10L	ring	17	25.5	28.6	26.4	14.9	6.15		
9/16/2003	41363		10R10L	ring	17	26.2	30.1	27.5	14.8	6.25		
9/16/2003	41372	41373	10R10L	ring	17	24.7	29.6	26.2	15.4	6.33		
9/16/2003	41184		10R10L	ring	21	28.5	33.2	28.8	16.3	7.95		
9/16/2003	41192		10R10L	ring	21	28.8	32.9	28.4	16.1	8.24		
9/16/2003	41193	41194	10R10L	ring	21	29.0	33.5	29.9	15.8	8.41		
9/16/2003	41190	41191	10R10L	ring	21	28.0	32.2	28.6	17.3	8.53		
9/16/2003	41187		10R10L	ring	21	29.9	33.4	28.7	16.6	8.60		
9/16/2003	41182		10R10L	ring	21	30.0	33.8	29.1	17.3	8.78		
9/16/2003	41185	41186	10R10L	ring	21	30.3	34.6	30.4	17.4	9.19		
9/16/2003	41188	41889	10R10L	ring	21	29.5	34.7	30.3	17.2	9.32		
9/16/2003	41726		10R10L	ring	22	27.8	30.5	27.0	15.2	7.04	8.9	13 marginals on right, anomalous V2-V3
9/16/2003	41732	41733	10R10L	ring	22	27.0	30.8	25.4	14.5	6.59	8.6	
9/16/2003	41727	41728	10R10L	ring	22	26.7	31.0	25.8	16.0	7.20	8.4	
9/16/2003	41731		10R10L	ring	22	27.2	30.7	26.9	15.6	7.22	8.4	
9/16/2003	41729	41730	10R10L	ring	22	26.6	30.8	27.1	15.8	7.34		
9/16/2003	41202		10R10L	ring	23	27.9	31.4	29.0	16.4	7.75		anomalous V4-V5
9/16/2003	41211	41212	10R10L	ring	23	27.8	32.1	28.5	15.6	7.55		
9/16/2003	41216	41217	10R10L	ring	23	28.4	31.7	29.1	16.2	7.60		
9/16/2003	41218		10R10L	ring	23	28.0	32.2	28.0	16.5	7.63		
9/16/2003	41215		10R10L	ring	23	28.0	31.9	29.2	15.8	7.69		
9/16/2003	41195		10R10L	ring	23	28.2	32.1	28.8	15.9	7.73		
9/16/2003	41200		10R10L	ring	23	28.1	32.1	29.3	15.6	7.73		
9/16/2003	41203	41204	10R10L	ring	23	28.4	32.5	29.3	15.4	7.84		
9/16/2003	41207		10R10L	ring	23	27.2	31.7	29.0	16.2	7.84		
9/16/2003	41213	41214	10R10L	ring	23	28.4	32.3	28.5	16.2	7.84		
9/16/2003	41198	41199	10R10L	ring	23	28.7	33.0	28.7	15.8	7.92		
9/16/2003	41210		10R10L	ring	23	27.7	31.7	28.5	16.2	7.98		
9/16/2003	41197		10R10L	ring	23	28.1	32.9	29.4	15.6	8.03		
9/16/2003	41205		10R10L	ring	23	29.4	32.6	29.6	15.6	8.22		
9/16/2003	41646		10R10L	ring	28	26.3	30.9	27.1	15.2	7.15		26 marginals anomalous V4-V5
9/16/2003	41633		10R10L	ring	28	27.4	32.7	27.5	16.5	7.65		anomalous V5

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/16/2003	41626	41627	10R10L	ring	28	26.3	31.5	27.4	14.4	7.12	8.5	
9/16/2003	41634	41635	10R10L	ring	28	26.4	31.7	26.5	15.4	7.12		
9/16/2003	41630		10R10L	ring	28	27.8	31.6	27.7	15.0	7.20		
9/16/2003	41639	41640	10R10L	ring	28	27.2	31.1	27.1	15.4	7.33		
9/16/2003	41643		10R10L	ring	28	27.8	31.9	28.5	15.1	7.33		
9/16/2003	41623		10R10L	ring	28	27.1	31.7	27.4	14.8	7.43	8.3	
9/16/2003	41628		10R10L	ring	28	27.0	30.9	27.2	15.5	7.52		
9/16/2003	41622		10R10L	ring	28	27.1	31.4	27.7	14.8	7.57	8.6	
9/16/2003	41625		10R10L	ring	28	27.7	31.8	27.8	15.7	7.62		
9/16/2003	41641		10R10L	ring	28	26.9	32.1	27.1	16.0	7.69		
9/16/2003	41631		10R10L	ring	28	27.9	32.3	28.0	15.2	7.73		
9/16/2003	41644	41645	10R10L	ring	28	27.4	32.0	28.1	15.8	7.79		
9/16/2003	41638		10R10L	ring	28	26.9	32.1	28.2	15.5	7.80		
9/16/2003	41654	41654	10R10L	ring	29	28.9	32.8	28.2	16.5	8.39	8.7	
9/16/2003	41680	41681	10R10L	ring	29	27.7	33.0	29.2	16.5	8.39	8.9	
9/16/2003	41689		10R10L	ring	29	28.8	34.2	29.6	16.4	8.69		
9/16/2003	41687		10R10L	ring	29	29.4	32.9	29.8	16.0	8.95	8.6	
9/16/2003	41657	41658	10R10L	ring	29	28.9	33.4	30.2	16.3	8.97	9.0	
9/16/2003	41652	41653	10R10L	ring	29	29.3	34.2	29.9	16.6	9.01	8.7	
9/16/2003	41685	41686	10R10L	ring	29	28.8	33.6	30.3	16.1	9.04	8.9	
9/16/2003	41683	41684	10R10L	ring	29	29.0	34.3	30.2	16.7	9.07	8.9	
9/16/2003	41662	41663	10R10L	ring	29	29.5	34.1	29.8	16.7	9.10	8.8	
9/16/2003	41651		10R10L	ring	29	28.9	34.4	29.6	16.0	9.28	8.7	
9/16/2003	41679		10R10L	ring	29	28.8	33.8	29.7	17.0	9.56		
9/16/2003	41682		10R10L	ring	29	29.2	34.2	29.8	16.5	9.70	9.1	
9/16/2003	41656		10R10L	ring	29	29.1	34.2	30.9	16.4	9.92	8.9	
9/16/2003	41344	41345	10R10L	ring	34	23.7	29.0	26.5	15.0	7.13		yolk sac, two tags, anomalous V4, left costals
9/16/2003	41349	41350	10R10L	ring	34	24.6	29.6	25.7	15.7	7.30		yolk sac, anomalous right costals, two tags
9/16/2003	41346		10R10L	ring	34	23.7	29.2	26.5	15.9	7.03		yolk sac
9/16/2003	41336		10R10L	ring	34	25.4	30.2	26.6	16.1	8.07		yolk sac
9/16/2003	41323		10R10L	ring	34	23.9	29.4	27.0	16.8	8.21		yolk sac
9/16/2003	41321		10R10L	ring	34	25.1	30.7	27.2	16.3	8.43		yolk sac
9/16/2003	41331		10R10L	ring	34	26.1	30.7	27.5	16.3	8.48		yolk sac
9/16/2003	41325		10R10L	ring	34	25.4	30.1	27.1	16.9	8.53		yolk sac
9/16/2003	41335		10R10L	ring	34	25.0	30.8	27.7	16.2	8.53		yolk sac
9/16/2003	41338		10R10L	ring	34	25.5	30.1	28.1	16.3	8.69		yolk sac
9/16/2003	41326		10R10L	ring	34	26.1	31.3	27.4	17.4	9.01		yolk sac
9/16/2003	41328		10R10L	ring	34	25.9	31.2	27.2	17.2	9.23		yolk sac
9/16/2003	41329	41330	10R10L	ring	34	26.1	31.2	27.0	17.5	9.30		yolk sac
9/16/2003	41318		10R10L	ring	34	26.1	31.0	29.4	16.8	9.37		yolk sac
9/16/2003	41320		10R10L	ring	34	27.1	30.9	27.4	16.8	9.38		yolk sac
9/16/2003	41333		10R10L	ring	34	25.0	30.4	27.2	16.0	9.73		yolk sac

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/16/2003	41341		10R10L	ring	34	24.8	26.3	26.4	16.1			yolk sac, two tags
9/16/2003	41310		10R10L	ring	38	26.6	30.8	26.4	16.8	7.80		yolk sac anomalous V3-V4, left costal
9/16/2003	41308		10R10L	ring	38	26.4	30.6	27.0	16.7	8.21		yolk sac anomalous V1-V2
9/16/2003	41282		10R10L	ring	38	25.9	31.4	27.6	17.3	8.60		yolk sac, anomalous V5, 26 marginals
9/16/2003	41305		10R10L	ring	38	24.5	29.1	25.1	15.2	6.66		yolk sac
9/16/2003	41284		10R10L	ring	38	23.6	29.6	29.8	16.5	6.90		yolk sac
9/16/2003	41311	41312	10R10L	ring	38	24.9	29.5	26.1	16.0	7.07		yolk sac
9/16/2003	41306	41307	10R10L	ring	38	24.8	29.8	26.5	16.2	7.63		yolk sac
9/16/2003	41298	41299	10R10L	ring	38	25.7	30.8	26.0	15.8	7.64		yolk sac
9/16/2003	41315		10R10L	ring	38	26.4	30.7	26.5	15.9	7.74		yolk sac
9/16/2003	41302		10R10L	ring	38	25.5	30.9	26.4	17.0	7.78		yolk sac
9/16/2003	41295		10R10L	ring	38	25.7	30.0	26.7	16.8	7.85		yolk sac
9/16/2003	41288	41289	10R10L	ring	38	25.6	30.6	27.7	17.2	7.98		yolk sac
9/16/2003	41280	41281	10R10L	ring	38	24.8	30.7	27.2	16.5	8.01		yolk sac
9/16/2003	41300		10R10L	ring	38	25.6	30.2	26.4	16.2	8.01		yolk sac
9/16/2003	41297		10R10L	ring	38	25.0	31.6	27.3	16.5	8.05		yolk sac
9/17/2003	41590	41591	10R10L	ring	13	26.6	30.2	25.6	15.4	6.51	8.6	anomalous V3-V5
9/17/2003	41608	41609	10R10L	ring	13	27.0	30.6	26.5	14.6	6.74	8.3	anomalousV4-V5
9/17/2003	41592		10R10L	ring	13	26.7	31.0	26.3	15.2	7.10	8.6	anomalous V5
9/17/2003	41597		10R10L	ring	13	27.5	30.6	26.1	15.5	7.11	8.6	large V4 small V5
9/17/2003	41589		10R10L	ring	13	26.4	31.0	26.9	14.8	6.70		
9/17/2003	41593	41594	10R10L	ring	13	26.7	31.1	26.9	13.6	6.82	8.6	
9/17/2003	41595	41596	10R10L	ring	13	26.8	30.6	26.2	16.0	6.82		
9/17/2003	41605		10R10L	ring	13	27.0	31.3	25.5	15.5	6.88		
9/17/2003	41612		10R10L	ring	13	27.0	31.0	26.7	15.7	6.92		
9/17/2003	41602		10R10L	ring	13	26.8	30.3	26.0	14.3	6.94		
9/17/2003	41600		10R10L	ring	13	26.5	31.3	27.6	15.8	7.21		
9/17/2003	41604		10R10L	ring	13	27.3	30.5	26.4	16.3	7.38		
9/17/2003	41599		10R10L	ring	13	28.1	31.7	27.1	15.5	7.41	8.6	
9/17/2003	41607		10R10L	ring	13	27.5	31.2	27.0	15.7	7.48		
9/17/2003	41565	41564	10R10L	ring	18	26.8	31.4	27.6	15.4	7.48		
9/17/2003	41561		10R10L	ring	18	28.0	31.9	27.6	15.3	7.59		
9/17/2003	41562	41563	10R10L	ring	18	28.4	32.4	27.9	15.5	7.61		
9/17/2003	41559		10R10L	ring	18	28.1	32.0	27.0	15.9	7.88		
9/17/2003	41567	41568	9L10L10R	ring	18	28.8	32.3	27.6	15.9	7.90		
9/17/2003	41554		10R10L	ring	18	28.4	32.6	27.3	15.4	8.03		
9/17/2003	41564		10R10L	ring	18	28.9	32.6	28.2	15.6	8.04		
9/17/2003	41556		10R10L	ring	18	27.9	31.6	27.7	15.3	8.08		
9/17/2003	41569		10R10L	ring	18	28.7	32.4	27.6	15.7	8.20		
9/17/2003	41557		10R10L	ring	18	28.4	32.4	28.0	15.7	8.27		
9/17/2003	41387		10R10L	ring	20	27.0	31.8	26.5	16.3	7.17		anomalous V4-V5
9/17/2003	41392		10R10L	ring	20	26.4	30.8	26.3	15.2	6.66		

Appendix: Table 1. 2003 Hatchlings sorted by date of emergence.

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/17/2003	41402		10R10L	ring	20	25.9	31.1	27.4	15.0	6.68		
9/17/2003	41552	41553	10R10L	ring	20	25.3	30.6	27.1	15.7	6.71		
9/17/2003	41394		10R10L	ring	20	27.1	31.4	27.8	16.3	6.85		
9/17/2003	41395	41396	10R10L	ring	20	25.7	31.9	27.7	16.0	6.90		
9/17/2003	41397		10R10L	ring	20	26.3	31.5	28.0	16.2	6.99		
9/17/2003	41403	41404	10R10L	ring	20	27.0	30.9	26.5	15.8	6.99		
9/17/2003	41389		10R10L	ring	20	26.8	31.4	27.3	16.3	7.17		
9/17/2003	41384		10R10L	ring	20	27.9	32.5	27.0	16.2	7.21		
9/17/2003	41385	41386	10R10L	ring	20	26.5	31.4	27.5	15.3	7.24		
9/17/2003	41400		10R10L	ring	20	27.0	32.5	27.6	16.1	7.26		
9/17/2003	41390	41391	10R10L	ring	20	25.6	30.7	27.8	16.1	7.63		
9/17/2003	41575	41576	10R10L	ring	26	28.4	34.1	29.7	16.6	9.54		large V4 small V5 anomalous V5
9/17/2003	41580	41581	10R10L	ring	26	28.5	34.0	30.9	16.6	9.93		anomalous V5
9/17/2003	41586		10R10L	ring	26	28.1	32.0	28.7	15.7	8.37		large V4 small V5
9/17/2003	41579		10R10L	ring	26	28.2	33.3	29.1	15.8	8.57		
9/17/2003	41587		10R10L	ring	26	27.6	32.2	28.7	15.9	8.58		
9/17/2003	41572		10R10L	ring	26	27.4	32.6	28.3	15.9	8.62		
9/17/2003	41574		10R10L	ring	26	29.0	33.3	29.1	16.0	9.36		
9/17/2003	41584		10R10L	ring	26	29.0	34.1	29.5	15.4	9.48		
9/17/2003	41577		10R10L	ring	26	29.4	33.4	29.7	16.8	9.60		
9/17/2003	41570	41571	10R10L	ring	26	29.3	34.3	29.8	16.6	9.68		large V4 small V5
9/21/2003	41723		10R10L	ring	24	25.4	29.0	25.0	15.6	6.16	8.0	
9/21/2003	41700		10R10L	ring	24	25.7	29.3	25.1	14.8	6.28	8.1	
9/21/2003	41716		10R10L	ring	24	25.9	30.4	26.5	14.3	6.42	8.3	two tags
9/21/2003	41713		10R10L	ring	24	27.1	30.3	25.9	14.9	6.46	7.9	
9/21/2003	41721		10R10L	ring	24	26.0	29.5	25.7	15.0	6.47	8.0	
9/21/2003	41708		10R10L	ring	24	26.8	29.8	25.6	14.6	6.49	8.2	
9/21/2003	41705		10R10L	ring	24	26.6	30.3	26.6	16.1	6.67	8.2	
9/21/2003	41693	41694	10R10L	ring	24	26.6	30.4	27.0	15.4	6.81	8.2	
9/21/2003	41690		10R10L	ring	24	26.3	30.3	26.1	15.5	6.85	8.4	
9/21/2003	41695		10R10L	ring	24	26.8	30.9	27.4	16.0	6.85	8.4	
9/21/2003	41703		10R10L	ring	24	27.3	30.5	25.9	16.0	6.86	8.0	
9/21/2003	41697		10R10L	ring	24	28.0	31.4	26.5	15.6	6.86		
9/21/2003	41718		10R10L	ring	24	26.6	30.8	26.9	14.9	6.96	8.3	
9/21/2003	41719	41720	10R10L	ring	24	27.4	30.7	26.6	15.7	7.12	8.2	
9/21/2003	41711		10R10L	ring	24	28.1	31.7	27.2	15.0	7.13	8.0	
9/21/2003	41706		10R10L	ring	24	28.9	31.8	27.0	15.7	7.13	8.5	
9/21/2003	41701	41702	10R10L	ring	24	27.7	31.8	27.2	16.2	7.20		
9/21/2003	41274		10R10L	ring	25	26.8	32.1	27.8	15.6	7.58		26 marginals, anomalous V5
9/21/2003	41243		10R10L	ring	25	28.1	32.3	28.6	15.7	8.10		13 marginals on right
9/21/2003	41254	41255	10R10L	ring	25	27.9	33.5	29.4	14.7	8.31		13 marginals on right
9/21/2003	41272		10R10L	ring	25	28.2	32.5	28.5	15.6	8.33		26 marginals, anomalous V4, right costals

Appendix: Table 1. 2003 Hatchlings sorted by date of emergence.

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/21/2003	41264		10R10L	ring	25	27.3	31.6	28.2	15.5	7.85		
9/21/2003	41246		10R10L	ring	25	27.8	32.5	28.3	15.8	8.07		
9/21/2003	41270	41271	10R10L	ring	25	28.1	32.9	28.4	15.7	8.18		
9/21/2003	41277		10R10L	ring	25	27.5	32.8	28.3	16.0	8.23		two tags
9/21/2003	41257	41258	9R10R10L	ring	25	27.9	32.2	29.1	15.9	8.25		
9/21/2003	41250	41249	10R10L	ring	25	28.2	32.8	28.7	15.9	8.30		
9/21/2003	41259		10R10L	ring	25	28.3	32.2	28.0	16.2	8.39		
9/21/2003	41261		10R10L	ring	25	28.2	33.1	28.9	15.3	8.46		
9/21/2003	41262	41263	10R10L	ring	25	28.0	32.7	28.7	16.2	8.48		
9/21/2003	41251		10R10L	ring	25	28.1	32.2	29.9	16.0	8.65		
9/21/2003	41256		10R10L	ring	25	28.9	33.6	29.7	16.1	8.71		
9/21/2003	41620		10R10L	ring	36	25.9	31.0	26.8	16.0	7.56	8.2	
9/21/2003	41316	41317	10R10L	ring	37	27.0	30.4	28.4	15.8	7.92		anomalous V4-V5
9/21/2003	41616	41617	10R10L	ring	37	28.0	31.3	27.8	16.0	8.40		anomalous V1-V4, left and right costals, 26 marginals
9/21/2003	41801	41802	10R10L	ring	39	24.3	28.9	24.6	15.4	6.02		yolk sac, anomalous V2-V5
9/21/2003	41803		10R10L	ring	39	25.2	29.0	24.8	14.8	6.12	8.0	yolk sac, anomalous V3-V4
9/21/2003	41773		10R10L	ring	39	24.6	29.1	25.9	15.2	6.62		yolk sac, anomalous V1-V4
9/21/2003	41780		10R10L	ring	39	26.0	31.5	26.4	16.2	7.49		anomalous V5
9/21/2003	41813		10R10L	ring	39	25.0	29.5	25.2	15.8	6.62		yolk sac
9/21/2003	41775		10R10L	ring	39	25.7	29.5	26.5	15.3	6.82		or 41774
9/21/2003	41776	41777	10R10L	ring	39	25.3	30.1	26.8	15.1	6.92		
9/21/2003	41772		10R10L	ring	39	26.6	30.7	25.0	15.2	7.18		yolk sac
9/21/2003	41785		10R10L	ring	39	25.4	29.4	27.0	15.8	7.36	8.4	yolk sac
9/21/2003	41796	41797	10R10L	ring	39	26.6	31.3	27.3	15.2	7.44	8.4	yolk sac
9/21/2003	41806	41807	10R10L	ring	39	25.6	29.6	26.3	17.0	7.53	8.5	yolk sac
9/21/2003	41786	41787	10R10L	ring	39	25.8	30.3	26.9	15.8	7.57	8.3	yolk sac
9/21/2003	41795		10R10L	ring	39	26.7	31.0	27.0	15.6	7.86	8.3	
9/21/2003	41829	41830	10R10L	ring	41	22.6	26.3	22.9	13.5	4.66	7.9	yolk sac, 13 marginals on right
9/21/2003	41836		10R10L	ring	41	23.6	27.0	23.6	14.4	5.17	8.0	yolk sac, anomalous V5
9/21/2003	41839	41840	10R10L	ring	41	23.0	26.7	23.4	14.7	5.34	7.9	yolk sac, anomalous V3-V5, 26 marginals
9/21/2003	41817		10R10L	ring	41	26.7	30.7	26.7	16.8	8.38	8.6	yolk sac, anomalous V3-V5, irregular 3L
9/21/2003	41833		10R10L	ring	41	22.8	26.7	23.7	14.2	4.90	7.9	yolk sac
9/21/2003	41815		10R10L	ring	41	28.6	31.7	26.8	17.4	8.80	8.5	yolk sac
9/21/2003	41821		10R10L	ring	41	27.5	33.0	28.0	16.9	9.42		yolk sac
9/22/2003	41724		10R10L	ring	51	25.5	30.5	26.4	17.5	8.12		yolk sac
9/22/2003	41648		10R10L	hand	Pier	28.2	32.3	28.0	16.5	7.63	8.8	
9/23/2003	41883	41884	10R10L	ring	40	26.2	29.6	25.8	15.6	6.96	8.2	yolk sac, anomalous V2-V5, anomalous right costals
9/23/2003	41896	41897	10R10L	ring	40	21.8	26.6	22.7	14.1	4.95	7.7	yolk sac
9/23/2003	41888		10R10L	ring	40	23.9	28.9	25.7	15.9	6.43	8.2	yolk sac
9/23/2003	41880		10R10L	ring	40	25.0	29.4	25.3	15.0	6.54	8.2	yolk sac
9/23/2003	41882		10R10L	ring	40	24.7	29.7	26.2	15.3	6.77	8.2	yolk sac
9/23/2003	41875	41876	10R10L	ring	40	24.1	29.6	25.6	16.4	6.89	8.2	yolk sac, saved

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/23/2003	41895		10R10L	ring	40	25.0	29.9	26.3	15.5	6.90	8.3	yolk sac
9/23/2003	41890		10R10L	ring	40	25.7	30.5	25.5	16.3	7.18	8.6	yolk sac
9/23/2003	41878	41879	10R10L	ring	40	26.2	30.5	26.5	15.4	7.32	8.3	yolk sac
9/23/2003	41877		10R10L	ring	40	26.6	31.9	28.1	15.2	7.62	8.3	yolk sac
9/23/2003	41873	41874	10R10L	ring	40	25.6	31.1	27.8	15.8	7.70	8.6	yolk sac, saved
9/23/2003	41872		10R10L	ring	40	26.1	30.2	26.6	16.7	8.08	8.4	yolk sac, saved
9/23/2003	41870	41871	10R10L	ring	40	26.8	31.8	27.4	16.7	8.30	8.2	yolk sac
9/23/2003	41867		10R10L	ring	41	23.2	26.7	24.0	13.6	4.96	7.8	yolk sac, 13 marginals on right side, anomalous V5
9/23/2003	41865	41866	10R10L	ring	41	28.6	31.7	27.0	17.2	8.55	8.7	yolk sac, anomalous V5, saved
9/25/2003	41937	41398	10R10L	ring	32	27.6	32.2	29.2	15.8	8.39	8.8	26 marginals, anomalous V4-V5
9/25/2003	41939		10R10L	ring	32	26.7	31.8	27.6	15.5	7.50	8.7	
9/25/2003	41944		10R10L	ring	32	26.8	31.4	28.1	15.6	7.70	8.7	
9/25/2003	41929		10R10L	ring	32	27.2	31.7	28.4	16.1	7.76	8.5	
9/25/2003	41931		9R10R10L	ring	32	26.8	32.3	29.0	15.6	7.81	9.0	
9/25/2003	41932	41933	10R10L	ring	32	27.3	31.5	28.5	16.3	7.95	8.7	
9/25/2003	41934		10R10L	ring	32	27.1	31.8	28.3	15.9	7.97	8.6	
9/25/2003	41926		10R10L	ring	32	26.8	32.3	29.7	16.3	8.21	8.8	
9/25/2003	41924		10R10L	ring	32	27.9	32.8	29.8	15.8	8.25	8.7	
9/25/2003	41942	41943	10R10L	ring	32	28.2	32.7	29.5	16.2	8.36	8.6	
9/25/2003	41922	41923	10R10L	ring	32	27.7	31.8	28.4	16.5	8.45	8.6	
9/25/2003	41906		10R10L	ring	33	28.2	32.8	28.6	16.5	9.02		anomalous V3-V4
9/25/2003	41919	41920	10R10L	ring	33	26.8	31.0	26.8	15.5	7.45	8.3	
9/25/2003	41901	41902	10R10L	ring	33	27.4	31.5	27.0	16.2	8.11	8.6	
9/25/2003	41898		10R10L	ring	33	28.6	32.1	27.9	16.1	8.25	8.5	
9/25/2003	41916		10R10L	ring	33	27.3	32.6	27.8	16.7	8.44	8.8	
9/25/2003	41900		10R10L	ring	33	27.6	32.0	27.8	16.7	8.60	8.5	
9/25/2003	41918		10R10L	ring	33	28.5	32.8	28.4	16.5	8.66		
9/25/2003	41914	41915	10R10L	ring	33	27.3	32.4	28.4	16.7	8.69	8.7	saved
9/25/2003	41913		10R10L	ring	33	27.9	33.5	27.2	16.6	8.73	8.6	
9/25/2003	41903		10R10L	ring	33	28.1	33.2	27.9	15.8	8.76	8.8	
9/25/2003	41910		10R10L	ring	33	28.5	33.1	28.1	15.8	8.82	8.6	
9/25/2003	41905		10R10L	ring	33	28.2	33.1	28.0	17.1	9.07		
9/25/2003	41911		10R10L	ring	33	29.1	34.3	27.8	17.2	9.25	8.6	
9/25/2003	41908		10R10L	ring	33	29.5	33.8	28.9	16.4	9.47	8.6	
9/26/2003	41949		10R10L	ring	37	24.8	28.5	26.6	14.5	6.03	7.7	23 marginals on right side, anomalous V1-2 + V5, saved
9/27/2003	41951		10R10L	ring	51	26.9	31.1	26.3	16.3	7.87	8.5	yolk sac, anomalous V5, 26 marginals
9/27/2003	41960	41961	10R10L	ring	51	24.4	29.2	25.3	15.9	6.64	8.0	yolk sac
9/27/2003	41952		10R10L	ring	51	26.6	29.4	26.0	15.2	6.64	8.2	yolk sac
9/27/2003	41957		10R10L	ring	51	25.6	30.0	26.0	16.0	6.89	8.2	yolk sac
9/27/2003	41955	41956	10R10L	ring	51	26.4	32.0	28.2	16.0	7.93	8.5	yolk sac
9/27/2003	41954		10R10L	ring	51	27.0	32.3	28.1	16.5	8.34	8.6	yolk sac
9/28/2003	41967		10R10L	ring	43	27.2	29.7	26.2	18.2	8.81	8.1	yolk sac

Appendix: Table 1. 2003 Hatchlings sorted by date of emergence.

Date of Emergence	ID 1	ID 2	Notch ID	Method of Capture	Nest Number	Plastron Length	Carapace Length	Width	Height	Mass	Head Width	Comments
9/28/2003	41965	41966	10R10L	ring	51	26.0	30.6	26.5	15.6	7.40	8.1	yolk sac
4/22/2004	41969		10R10L	ring	44	29.1	32.7	28.3	15.5			
4/22/2004	41972		10R10L	ring	43	26.6	30.6	28.2	15.7			
These animals were measured on 29 June 2004 and were held over the winter in the administration trailor												
10/22/2003	41974		10R10L	ring	43	41.0	48.0	39.0	21.1	23.0		Anamolous V5
10/22/2003	41962		10R10L	ring	43	41.6	48.2	38.6	21.4	22.3		
10/22/2003	41956		10R10L	ring	43	40.8	47.6	39.0	22.3	22.2		
10/22/2003	41927		10R10L	ring	43	34.0	39.2	34.2	17.8	13.7		Anamolous V5
10/22/2003	41886	41887	10R10L	ring	43	34.6	39.5	33.4	18.3	13.6		Anamolous V5
10/22/2003	41885		10R10L	ring	43	36.1	41.4	35.3	19.1	15.3		Anamolous V5
10/22/2003	41860	41861	10R10L	ring	43	33.9	39.0	32.6	18.7	12.7		
10/22/2003	41849		10R10L	ring	43	37.7	45.0	36.7	21.0	19.2		Anamolous V5

Appendix Table 2. Nests located during the 2003 nesting season. Included are statistics of nest fate, the number of hatchlings recovered and how the nests were discovered. ** - all eggs in the nest were partially developed.

Date	Nest	Latitude	Longitude	Cell/Area	Live Hatchlings	Dead Hatchlings	Undeveloped Eggs	Source	Fate of Nest
6/12/2003	1	38 45.085	76 22.363	Cell 5	10			Ovipos	Emerged
6/13/2003	2	38 45.095	76 22.330	Cell 5	1		5	Ovipos	Emerged
6/16/2003	3	38 45.074	76 22.383	Cell 5	11		2	Ovipos	Emerged
6/16/2003	4	38 45.067	76 22.265	Cell 5	16			Ovipos	Emerged
6/16/2003	5	38 45.009	76 22.117	Cell 5	8		1	Ovipos	Emerged
6/16/2003	6	38 44.968	76 22.020	Cell 5	18			Ovipos	Emerged
6/16/2003	7	38 45.631	76 22.792	Cell 3D	6		4	Ovipos	Emerged
6/16/2003	8	38 45.090	76 22.488	Notch	11			Ovipos	Emerged
6/20/2003	9	38 45.073	76 22.463	Cell 5				Ovipos	Nest could not be found
6/23/2003	10	38 45.080	76 22.469	Cell 5				Ovipos	Hatched between 9/16-9/21
6/23/2003	11	38 45.077	76 22.375	Cell 5	8		1	Ovipos	Emerged
6/23/2003	12	38 45.071	76 22.277	Cell 5				Ovipos	Nest could not be found
6/24/2003	13	38 45.160	76 22.476	Notch	14		4	Ovipos	Emerged
6/24/2003	14	38 45.217	76 22.434	Notch	14			Ovipos	Emerged
6/24/2003	15	38 45.009	76 22.120	Cell 5				Ovipos	Nest could not be found
6/24/2003	16	38 45.629	76 22.788	Cell 3D	4			Ovipos	Lost in Hurricane
6/25/2003	17	38 45.051	76 22.218	Cell 5	20			Ovipos	Emerged
6/26/2003	18	38 45.115	76 22.492	Notch	10			Ovipos	Emerged
6/26/2003	19			Cell 3D				Ovipos	Nest could not be found
6/26/2003	20	38 45.784	76 22.834	Cell 3D	13			Ovipos	Emerged
6/26/2003	21	38 45.085	76 22.308	Cell 5	8	1		Ovipos	Emerged
6/27/2003	22	38 45.076	76 22.287	Cell 5	5			Dest	Depredated
6/27/2003	23	38 45.063	76 22.250	Cell 5	14			Ovipos	Emerged
06/28-07/09/03	24	38 45.200	76 22.443	Notch	17			Ovipos	Emerged
06/28-07/09/03	25	38 45.141	76 22.489	Notch	15		1	Ovipos	Emerged
06/28-07/09/03	26	38 45.111	76 22.492	Notch	10			Ovipos	Emerged
06/28-07/09/03	27	38 45.036	76 22.179	Cell 5				Ovipos	Nest could not be found
06/28-07/09/03	28	38 45.026	76 22.154	Cell 5	15			Ovipos	Emerged
06/28-07/09/03	29	38 44.961	76 22.998	Cell 5	13		1	Ovipos	Emerged
7/10/2003	30	38 45.108	76 22.491	Notch			Rotten Nest	Ovipos	Rotten Nest
7/10/2003	31	38 45.070	76 22.398	Cell 5				Ovipos	Hatched between 9/16-9/23
7/10/2003	32	38 45.089	76 22.355	Cell 5	11		1	Ovipos	Emerged
7/11/2003	33	38 45.186	76 22.456	Notch	14		1	Ovipos	Emerged
7/14/2003	34	38 45.631	76 22.789	Cell 3D	17			Ovipos	Emerged
7/17/2003	35	38 45.644	76 22.796	Cell 3D				Ovipos	Lost in Hurricane
7/18/2003	36	38 45.076	76 22.380	Cell 5	1	1		Ovipos	Small clutch, potential hatchling escape
7/18/2003	37	38 45.064	76 22.430	Cell 5	3	4	2	Ovipos	Overwinter

Appendix Table 2. Nests located during the 2003 nesting season. Included are statistics of nest fate, the number of hatchlings recovered and how the nests were discovered. ** - all eggs in the nest were partially developed.

Date	Nest	Latitude	Longitude	Cell/Area	Live Hatchlings	Dead Hatchlings	Undeveloped Eggs	Source	Fate of Nest
7/18/2003	38	38 45.636	76 22.790	Cell 3D	17			Ovipos	Emerged
7/20/2003	39	38 45.064	76 22.430	Cell 5	13			Ovipos	Emerged
7/20/2003	40	38 45.064	76 22.429	Cell 5	13			Ovipos	Emerged
7/20/2003	41	38 45.069	76 22.400	Cell 5	9	1		Ovipos	Emerged
7/22/2003	42	38 45.797	76 22.835	Cell 3D				Ovipos	Lost in Hurricane
7/24/2003	43	38 45.028	76 22.162	Cell 5	9		1	Ovipos	Overwinter
7/24/2003	44	38 45.071	76 22.392	Cell 5	1	14		Ovipos	Overwinter
7/25/2003	45	38 45.771	76 22.827	Cell 3D	1	1		Ovipos	Lost in Hurricane
7/28/2003	46	38 45.073	76 22.387	Cell 5				Ovipos	Overwinter - Could not locate nest in Spring
7/28/2003	47	38 45.042	76 22.193	Cell 5				Ovipos	Overwinter - Could not locate nest in Spring
7/28/2003	48	38 45.79	76 22.835	Cell 3D				Ovipos	Lost in Hurricane
7/28/2003	49	38 44.970	76 22.023	Cell 5				Ovipos	Lost in Hurricane
7/28/2003	50	38 44.965	76 22.089	Cell 5				Ovipos	Lost in Hurricane
7/28/2003	51	38 45.056	76 22.227	Cell 5	7			Ovipos	Emerged
7/28/2003	52	38 44.962	76 21.999	Cell 5				Ovipos	Lost in Hurricane
8/1/2003	53	38 45.049	76 22.207	Cell 5		3	5	Ovipos	Overwinter
8/11/2003	54	38 45.092	76 22.364	Cell 5			**	Ovipos	Overwinter
8/7/2003	55	38 44.984	76 22.064	Cell 5				Hatch	Emerged
8/13/2003	56	38 44.987	76 22.068	Cell 5				Hatch	Emerged
8/13/2003	57	38 44.986	76 22.052	Cell 5				Hatch	Emerged
8/14/2003	58	38 45.082	76 22.368	Cell 5				Hatch	Emerged
8/25/2003	59	38 45.069	76 22.399	Cell 5				Hatch	Emerged
8/25/2003	60	38 45.075	76 22.384	Cell 5			2	Hatch	Emerged
8/25/2003	61	38 45.642	76 22.642	Cell 3D		3	1	Hatch	Emerged
8/26/2003	62	38 45.624	76 22.784	Cell 3D				Hatch	Emerged
8/27/2003	63	38 45.063	76 22.247		2		1	Hatch	Emerged
9/2/2003	64	38 45.081	76 22.464	Cell 5		1		Hatch	Emerged
9/5/2003	65	38 45.074	76 22.392					Hatch	Emerged
9/15/2003	66	38 44.985	76 22.056	Cell 5			1	Hatch	Emerged
9/15/2003	67	38 45.075	76 22.383	Cell 5				Hatch	Emerged