



# Project Terrapin LLC

at Barnegat Bay, NJ  
*"Learning more through research"*

---

## Project Terrapin 2021 report for permit #2021091

**We conducted mark-recapture research on Cedar Run Dock Road, which is summarized below. We monitored terrapin nesting surveys on Mill Creek Road in Manahawkin, NJ. We also included our N. Sedge Island data first. Spreadsheets with all captures will be sent to the Endangered and Non-game species program. We will be sending GIS maps that show terrapin occurrences from Cedar Run Dock Road.**

### **1. Mark and recapture study at North Sedge Island to recover and mark new female terrapins on the Island.**

Over the past 17 field seasons, terrapins were hand-captured when they nested and were returning back to the water after oviposition. Some terrapins were captured prior to nesting and were measured. All terrapins were measured for straight-line carapace length, carapace width, plastron length using a 40 cm tree caliper, and were massed (g) using an Ohaus® digital scale ( $\pm 0.1$  g). New terrapins were notched using a marginal notch code system and were injected into the right rear leg with a 12 mm (134 KHz) passive integrated transponder (PIT) tag. All terrapins were scanned to determine PIT tag reading using a BioMark Multiple Portable Reader (MPR). We employed the use of High Definition Tags (HDX). All terrapins were hand-captured on North Sedge Island at Barnegat Bay, New Jersey (Table 1). A detailed list is included as an attachment with positions on the Island. **GPS was used throughout the study as the terrapins nested on the west or east lawn areas. However, marked locations were within a small spatial distribution thus marked as East or West lawn.**

**Table 1. Summary of total number of females captured, new captures and mean measurements (mm and g) on North Sedge Island over the past ten seasons (2012 – 2021).**

<b>Dates</b>	<b>Total Number of Females Captured</b>	<b>New Captures</b>	<b>Where captured</b>	<b>Mean Straight Carapace Length (mm)</b>	<b>Mean Mass (g)</b>
5/26 – 7/16/12	66	7	N. Sedge Island	195	1239
6/9 – 7/23/13	66	9	N. Sedge Island	194	1271
6/13 – 7/22/14	74	6	N. Sedge Island	195	1266
6/7 – 7/7/2015	64	2	N. Sedge Island	198	1317
6/10 – 7/19/2016	67	11	N. Sedge Island	195	1270.7
6/11 – 7/20/2017	73	13	N. Sedge Island	195.4	1329.3
6/1 – 7/20/2018	53	7	N. Sedge Island	195.3	1373.2
6/24 – 7/13/2019	15	3	N. Sedge Island	197.6	1243.6
6/19 – 7/22/2020	15	2	N. Sedge Island	198.5	1238.5
	1		N. Sedge Island		

**2. Analyze clutch sizes and relocate terrapin nests on North Sedge Island from areas with high human interactions (walking, lawn cutting, and recreation areas)**

In the past, terrapin nests that were dug in areas with high human foot traffic and areas that the lawn was “maintained” were relocated to an area on the west side of North Sedge Island. All eggs were excavated individually, measured using a plastic 150 mm digital caliper, weighed using an Ohaus portable balance ( $\pm 0.1$ g) and transported in a plastic container containing the same soil from the nest that they were recovered within 24 hours of oviposition. Nests were identified as those from known female terrapins versus those that were exposed as a result of predation and there was no known female nesting. Eggs were recovered and marked to maintain a consistent orientation, and were relocated using the same orientation and depth in the nest cavity. All nests were protected using  $\frac{1}{4}$ ” mesh wire containers that allow for proper sunlight and to contain hatchlings once emerged. Nests were monitored daily, then hourly after the minimal incubation time (60 days) that was recorded on Sedge in the past. Below is a summary of mean clutch size, egg lengths (mm) and egg mass (g) for all known nests (Table 2). Hatching success was reported as a percentage of successful hatching and emergence of hatchlings from known nests. Unknown nests, as a result of predation and necessary excavation (beyond the 24-hour window) were not included in the hatch success data.

**Table 2. Overall summary of numbers of nests, mean clutch size, mean egg length and mass for all clutches and all eggs oviposited by known females on N. Sedge Island (2012 – 2021).**

Year	Number of Nests	Mean Clutch Size	Mean Egg Length (mm)	Mean Egg Mass (g)
2012	40	13.4 (n=40)	31.7 (n=515)	8.3 (n=515)
2013	29	13.1 (n=29)	31.7 (n=362)	8.4 (n=362)
2014	53	12.6 (n=53)	32.4 (n=611)	8.7 (n=611)
2015	54	12.6 (n=54)	32.7 (n=680)	8.7 (n=680)
2016	57	12.1 (n=57)	32.7 (n=578)	9.1 (n=578)
2017	47	11.7 (n=47)	33.1 (n=464)	7.1 (n=464)
2018	27	12.1 (n=27)*	32.7 (n=340)	7.6 (n=340)
2019	12	13.0 (n=12)	33.3 (n=156)	8.5 (n=156)
2020	6	12.2 (n=6)	33.5 (n=20)	*9.5 (n=20)*
2021	1	N/A	N/A	N/A

\*Such a low number of eggs analyzed, data not credible for 2020 and no measured eggs in 2021. Re-visited 2017 mean egg mass, but 2018 confirmed that the number was possible. Maybe there was a reduction in available resources at the start of nesting season for females, thus less egg mass.

### 3. To determine hatch success on the Island based on number of eggs

After eggs reached the 60-day mark, nests cage covers were routinely checked for the signs of emergence. Once hatchlings were visible, nests were excavated to determine number of hatchlings emerged. All hatchlings were immediately measured using plastic 150 mm digital calipers and an electronic digital scale ( $\pm 0.1$  g). Hatching success was dependent upon the number of successful hatchlings versus the number of eggs per clutch. All hatchlings were immediately released back to the marsh adjacent to the nesting area. All hatchlings were notched on the same two marginal scutes with a code specific to 2012. Nests that showed no sign of emergence were excavated after 80 – 90 days to determine viability of eggs. If not hatched, but viable, eggs were re-covered until successful emergence. For nests in the fall, mid to late- September, hatchlings were recovered from nests that were incubating more than 105 days (previous, longest incubation time recorded on N. Sedge Island (Wnek et al. 2013). In 2016, half of the nests were assessed and the threat of storm surge from Hurricane Hermine forced us to move the remaining 50% of the nests on September 2, 2016 from N. Sedge Island to hatch at the MATES School. As a result, those hatched at the school showed a significant decrease in the hatchling success possibly due to the movement of eggs in the final stage of development. In 2017, we had incubation days in excess of 105 days and all remaining nests were excavated and moved to MATES on October 7, 2017. We found a significantly higher number of failed eggs than in the past, possibly due to the increased precipitation and cooler temperatures. The combination increases incubation time (cooler temperatures and increased soil moisture). As a result, we listed the hatchling percentages, but these are not indicative of the percentages that are considered “baseline” for N. Sedge Island.

**Table 3. Overall hatch success on N. Sedge Island through 2020. Included are 2012 through 2018 data for comparative purposes. Hatch success was higher for the nests with known females moved within the 24 hour window of time after oviposition. In comparison, unknown nests found as a result of predation demonstrated a lower hatching success.**

Year	Number of Known Clutches	Total Number of Eggs	Total Number of Hatchlings	Hatch %	Unknown Hatch %
2012	40	534	395	74.0	N=17 nests 66.4% (75 out of 113 eggs)
2013	29*	362*	274	75.7	N=2 nests 46.7% (7 out of 15 eggs)
2014	52	666**	405**	87.7**	N=3 nests 7.5% (2 out of 30 eggs)
2015	54	680***	286***	73.5***	N=2 (None Hatched)
2016	57	578	371 <sup>t</sup>	64.2 <sup>t</sup>	N/A
2017	47	483	166 <sup>t</sup>	34.2 <sup>t</sup>	N/A
2018	27	328	201	61.0	N=3 100% N=2 (No hatch)
2019	12	154	60	39.0	Low Hatch Success
2020	6	73	20	27.4	N=2 (No Hatch)
2021	N/A	N/A	N/A	N/A	N/A

\*Significantly lower number of clutches and eggs on N. Sedge Island.

\*\* This was calculated out of 462 eggs as 13 nests did not have hatching as of October 13, 2014. Nests were left on N. Sedge Island for overwintering.

\*\*\* We had 15 nests that were predated on N. Sedge Island, thus our hatching percent is based out of 389 eggs (lost eggs and predated nests)

<sup>t</sup>Data was not collected similarly and moving of nests seemed occurred in 2016 and 2017. In 2016, we had mixed hatch success as half of the nests were removed from N. Sedge Island on September 2, 2016 as a result of Hurricane Hermine that was expected to cause high storm surge. The nests were incubated at MATES and we do not include this as a result of egg failure from moving eggs.

<sup>t</sup>In 2017, we had multiple nest failures as a result of cooler incubation temperatures and the higher rainfall periods from August through October 2017. We excavated over 20 nests in on October 7, 2017 to hatch at the MATES school in which we had a low hatch success. Overall, our hatch success was approximately 34%.

In 2018, three nests had all possible hatchlings emerge. Two nests totally failed. There was late emergence in excess of 70 days in all cases.

In 2019, 2020, & 2021 there was a significant reduction in nesting result of loss of nesting habitat.

Summary: N. Sedge Island is showing a significant decline in recent years. The nesting effort has significantly declined as a result of less nesting habitat each year.

4. Overall number of terrapins captured and marked (males, females and juveniles at Cedar Run Dock Road from 2016 – 2021. Recaptures, marked from previous years were noted as well. We will complete the data from Courtney Parks in terms of recaptured terrapins from previous years.

Year	Total Number of Terrapins Captured	Number of Females	Number of Males	Number of Juveniles	Number of Terrapins Recaptured (from prior years)
2016	52	52	-	-	-
2017	221	196	20	5	13
2018	325	319	1	5	77
2019	632	613	16	3	167
2020	89	86	2	1	46
2021	68	66	-	2	23
2021	84*	84	-	-	TBD
<b>Totals</b>	<b>1471</b>	<b>1416</b>	<b>39</b>	<b>16</b>	<b>326</b>

*\*Courtney Parks captured females as part of her study with analysis to follow.*

*We have a total of 1471 terrapins marked at Cedar Run Dock Road as of August 1, 2021.*

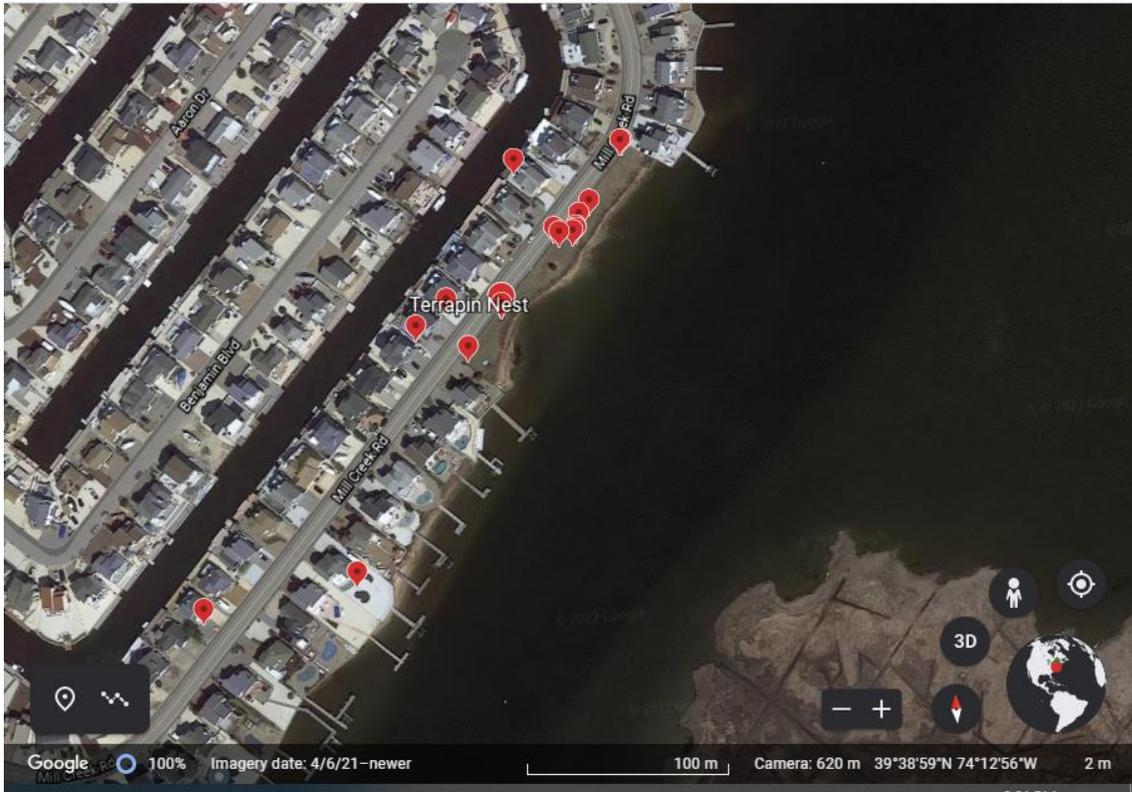
**We had 5 known road mortality on Cedar Run during 2021**

**The Burger family had 174 observations on Cedar Run Dock Road that we are using to assess the occurrence of terrapins in relationship to tidal stages using GIS. The map will be sent to NJ Fish and Wildlife and to Stafford Township.**

5. Capture details for the Cedar Run Dock Road from 2016 – 2021. All terrapins were PIT tagged and notched with morphometrics reported (Straight Carapace Length and Plastron Length, mm; Mass, g  $\pm$  1 SD). Juveniles were not reported in this table and will be reported in Table \_\_\_ below.

Year	Designation	Capture Method	Number	Mean Carapace Length (mm; $\pm$ 1 SD)	Mean Plastron Length (mm; $\pm$ 1 SD)	Mean Weight (grams; $\pm$ 1 SD)
2016	Female	Road	52	173.6 $\pm$ 12.6	158.2 $\pm$ 11.2	896.9 $\pm$ 196.1
2017	Female	Road	67	179.6 $\pm$ 17.0	161.2 $\pm$ 12.6	996.4 $\pm$ 242.1
	Female	Traps	129	177.5 $\pm$ 13.5	159.4 $\pm$ 11.3	957.6 $\pm$ 203.3
	Male	Traps	20	115.5 $\pm$ 8.0	98.0 $\pm$ 59.0	238.6 $\pm$ 59.0
2018	Female	Road	148	176.7 $\pm$ 11.0	160.6 $\pm$ 10.8	954.0 $\pm$ 181.4
	Female	Traps	177	177.0 $\pm$ 13.0	159.3 $\pm$ 14.0	964.4 $\pm$ 198.9
2019	Female	Road	471	176.3 $\pm$ 11.1	159.8 $\pm$ 10.7	956.2 $\pm$ 185.2
	Female	Traps	161	176.0 $\pm$ 13.1	158.8 $\pm$ 12.2	945.5 $\pm$ 201.6
	Male	Traps	16	117.0 $\pm$ 7.4	98.1 $\pm$ 8.4	246.7 $\pm$ 46.9
2020	Female	Road	47	176.7 $\pm$ 17.8	159.6 $\pm$ 10.8	972.8 $\pm$ 193.8
	Female	Traps	39	171.6 $\pm$ 17.1	155.0 $\pm$ 14.0	868.4 $\pm$ 214.6
	Male	Traps	2	117.0 $\pm$ 4.2	112.0 $\pm$ 1.4	236.5 $\pm$ 21.9
2021	Female	Road	58	177.3 $\pm$ 11.7	162.0 $\pm$ 8.9	953.3 $\pm$ 118.6
	Female	Traps	8	181.5 $\pm$ 11.6	162.5 $\pm$ 11.1	1068.4 $\pm$ 205.9

6. View of Mill Creek in Beach Haven West, NJ with 23 terrapin nests documented between June 9 and July 7, 2021. Most nesting occurred at an open space (park) on Mill Creek Road. We thank terrapin spotters Joseph and Fran Kosa. Terrapin nests were protected using cages after female terrapin oviposition. Nest covers were removed after two weeks and no other assessments were conducted (no egg and clutch assessments). GPS points are available for nesting.



Overall Summary: We will continue our monitoring program at Mill Creek and will continue to conduct a population assessment on Cedar Run Dock Road.