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Kennard Watson, Turtle Watch Director
Panama City Beach Turtle Watch, Inc.
6509 Palm Court
Panama City Beach, Florida 32408

Robbin Trindell, Ph.D.
Imperiled Species Management
Florida Fish and Wildlife Conservation Commission
620 South Meridian Street
Tallahassee, Florida 32399-1600

References: 1. Watson, K.P and Lamont, M.M. 2021. Temperature-based modeling of incubation period to protect loggerhead hatchlings on an urban beach in Northwest Florida. *Journal of Experimental Marine Biology and Ecology*. 546. 10.1016/j.jembe.2021.151647.
2. Hirama, S., 2018. Evaluation of the impact of artificial lighting on sea turtle hatchling orientation. Ph.D. dissertation, University of Florida, Gainesville, FL, 127 pages.

Dear Robbin:

This letter summarizes results of disorientation incidents during the 2023 nesting season on Panama City Beach under Permit 271. The survey area extends 17.5 miles between St. Andrews State Park and Camp Helen State Park and is covered by two lighting ordinances. Major results are as follows:

- 1169 of 2244 hatchlings (52%) were disoriented by artificial lights from 20 loggerhead nests and 6 green nests. Nests were checked every night from July 19 to September 13 and two nights on September 29 and October 5.
- Disorientation reports were filed for 16 loggerhead nests and 4 green nests where at least 5 hatchlings were disoriented. Two reports were filed for adult turtles documented during morning surveys.
- 644 disoriented hatchlings were collected during night monitoring and released on a nearby dark beach within the survey area. None required rehabilitation.
- No dead hatchlings were collected during night monitoring; however, we estimated hatchling mortality of 6% (132 of 2244) from dead turtles collected morning surveys and tracks disappearing in dunes and crab holes.

All disorientation reports have been provided to local code enforcement and submitted into FWC's web-based system. The following provides detailed results and includes a description of the methodology to quantify disorientations and types of lights contributing to the incidents.

Monitoring Procedure. All nests identified during the morning surveys were marked with four stakes, flagging tape, and an informational sign with the nest number. They were checked for evidence of emergence each morning (6-8 am), early evening (7-9 pm), and late night (10-12 pm). The early morning checks were done by paid surveyors starting immediately after the nest was found. Volunteers performed the nightly checks beginning on a date determined from measured sand temperatures in the vicinity of the nest (Reference 1). The nightly surveys were supplemented with a wildlife camera, used for the first time this year to monitor late-season nests, enabling remote monitoring without the need for nighttime checks. The camera was placed near the marked border of nests (not within marked area) to ensure no interference with emerging hatchlings. The camera was programmed to take no-glow (no flash) infrared images at regular intervals which could be viewed remotely using a cellular service.

Referring to Table 1, the nighttime spot checks were subject to the following monitoring requirements by FWC described in Permit 271, the second year of these new procedures:

- Maximum of two volunteers monitoring nests with each check taking no longer than 10 minutes.
- Monitoring personnel required to maintain a log of each spot check.
- Results reported to FWC include start and end times of spot checks, disoriented live and dead hatchlings collected, number of bystanders, and any turtles taken to a rehab facility.

Method to Quantify Hatchling Disorientation. We estimated hatchling disorientation using the “Direct Observation” method, described in Reference 1. This method estimates disorientation during nighttime monitoring through direct observation of hatchlings during emergence or from hatchling tracks and live turtles collected shortly after the emergence. The number of disoriented hatchlings included those crawling in the wrong direction away from the water (misoriented) and those showing uncertainty by changing direction or circling (disoriented), regardless of whether they eventually reached the water. Disorientation was confirmed by allowing hatchlings to crawl at least 20 feet before they were collected and released on a nearby dark beach within the survey area. Lights contributing to disorientation incidents were documented mostly during night surveys, immediately after the emergence event.

We did not collect Hatchling Orientation Index (HOI) data this season but plan to resume data collection next year, following the development of training procedures which will allow morning surveyors to collect this data. See Reference 2 for information on this method.

Method to Quantify Hatchling Mortality. We quantified mortality of disoriented turtles using direct and indirect methods. The direct method involved collecting dead hatchlings which are typically found in the dunes but sometimes on the road after an emergence. This number underestimates actual mortality, because disoriented hatchlings are difficult to find once they enter dune vegetation, where they are vulnerable to predation by ghost crabs and feral cats prevalent on our beach. Therefore, we also used an indirect method that assumed mortality occurred for any track entering the dune without exiting and where no hatchling was found. Adding this value to the count of dead turtles collected provides a more realistic estimate of mortality from artificial lights.

Data Set. Of the 46 nests found this season, disorientation was estimated for 26 nests (20 loggerhead, 6 green) that hatched at night, including those at which no disorientation occurred. Twenty (20) nests were excluded from the data set. Of these, 13 failed to hatch due to flooding or wash-out and 7 hatched nests (10,20,25,31,34,43,46) were excluded because disorientation could not be quantified due to absence of hatchling tracks.

Hatchling Disorientation Results. Table 2 shows main emergence results for nests that hatched at night. The column “Total Emerged” represents the main emergence excluding small numbers that may have emerged before or after. Also provided is information on the time of emergence, number of live disoriented hatchlings collected, dead disoriented hatchlings collected, and whether a disorientation report was filed. Results are as follows:

- Combined hatchling disorientation was 52% (1169 of 2244 hatchlings from 20 loggerhead nests and 6 greens).
- 644 disoriented hatchlings were collected during monitoring and released on a dark beach within our survey area.

- No dead turtles were collected at night, but 5 were found during morning surveys and 127 hatchlings were lost in dune vegetation or crab holes and assumed to have perished, giving a combined mortality of 6% (132 of 2244 hatchlings from 20 loggerhead nests and 6 greens).
- Figure 1 shows lights contributing to 20 disorientation incidents where 5 or more hatchlings were affected. Condo lights were the largest contributor at 32% (interior and exterior). Urban glow and streetlights contributed 21% and 10%, respectively.
- Log sheet results of nighttime monitoring (Table 1) are available at https://docs.google.com/spreadsheets/d/1ZvOvEns4ljChw6uE-1wEX54OJ-Qtx2MEOqeM_8IOMiI/edit?usp=sharing

Adult Disorientation Results. Adult females became disoriented at one nest and one false crawl. Disorientation was assessed by examining the crawl during the morning survey after the turtle had returned to the water. Reports were filed for both incidents.

If you have questions on this material, please contact me during business hours at (850) 238-9895 or at pcbturtle@yahoo.com. Thanks.

Sincerely,

Kennard Watson

Kennard Watson
Turtle Watch Director

cc: Meghan Koperski (FWC Tequesta), Patty Kelly (FWS Panama City), Timothy Justice (Bay County Code Enforcement), Lanie Smith (PCB Code Enforcement), Mel Leonard (PCB), Drew Whitman (PCB), Dan Rowe (TDC), Lisa Armbruster (Sustainable Beaches)

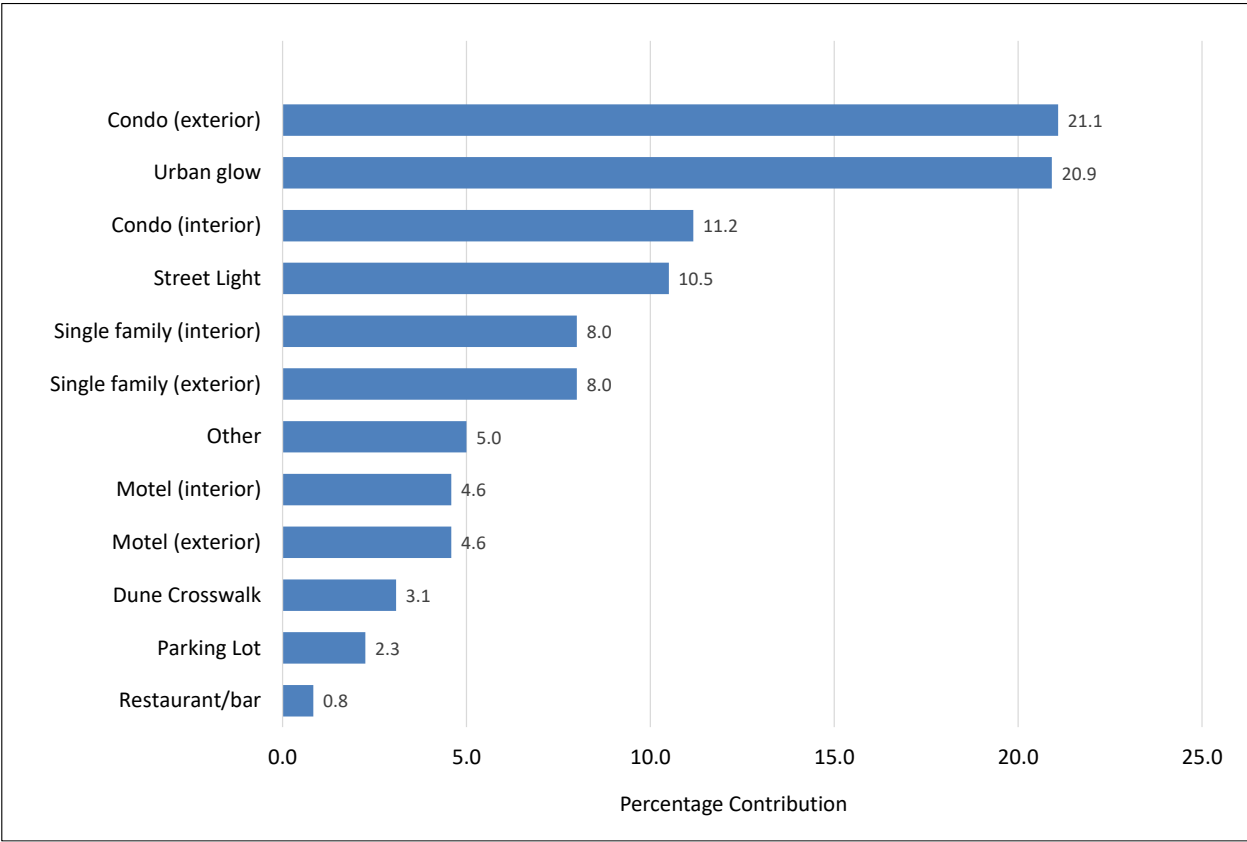


Figure 1. Lights contributing to hatchling disorientation incidents on Panama City Beach in 2023 (16 loggerhead nests, 4 green nests).

Table 1. Reporting requirements for nighttime hatchling monitoring under MTP-271.

Item	Requirement
1	Date disoriented hatchling recovery activities were initiated
2	Date disoriented hatchling recovery activities were terminated
3	Total number of disorientation events documented
4	<p>Spreadsheet providing information related to each nest check; a spreadsheet related to each disorientation event response and an evaluation of the 2023 season. The spreadsheet of nest checks must list for each nest subject to nest checks, minimally:</p> <ol style="list-style-type: none"> a. nest ID; b. date nest discovered; c. projected hatch date; d. date and time (i.e., HH:MM) of arrival for each nest check; e. date and time (i.e., HH:MM) of departure from each nest check; f. nest status at each check
5	<p>Disorientation event spreadsheet in the summary must list for each disorientation event, minimally:</p> <ol style="list-style-type: none"> a. date of the event; b. form of event notification (i.e., call, text or nest check); c. time of the notification if call or text (i.e., HH:MM); d. time Authorized Personnel arrived at the nest (i.e., HH:MM); e. time Authorized Personnel departed the nest (i.e., HH:MM); f. time of the event (e.g., HH:MM if observed in progress, prior to first nest check at HH:MM; after last nest check at HH:MM); g. number of Authorized Personnel present at the event; h. number of public present at the event; i. number of live disoriented hatchlings recovered; j. number of dead disoriented hatchlings recovered; k. number of disoriented hatchlings released; l. number of disoriented turtles transported to a FWC-authorized sea turtle rehabilitation facility
6	Summary sent to MTP@MyFWC.com or uploaded as a report to this permit within FWC's Online Permit System

Table 2. Nighttime hatchling emergences on Panama City Beach in 2023 (20 Cc loggerhead nests, 6 Cm green nests).

Nest No.	Species	Nearest Landmark	Incident Date	Emergence Time	Total Emerged	Number Disoriented	Percent Disoriented	Live Collected	Dead Collected	Report Filed
1	Cc	House, 22339 Front Beach Rd	29-Jul	9:10 PM	104	3	3%	3	0	N
2	Cc	Pinnacle Port Condo, 23223 Front Beach Rd	21-Jul	10:20 PM	142	142	100%	144*	0	Y
3	Cc	Osprey Motel, 15801 Front Beach Rd	31-Jul	9:30 PM	153	17	11%	17	0	Y
4	Cc	House, 5407 Gulf Dr	5-Aug	8:20 PM	91	78	86%	78	0	Y
5	Cc	House, 20816 Front Beach Rd	9-Aug	9:30 PM	70	46	66%	46	0	Y
6	Cc	House, 318 Beachside Dr, Carillon Beach	8-Aug	10:20 PM - 7 AM	81	76	94%	0	0	Y
7	Cc	House, 22115 Front Beach Rd	13-Aug	11:32 PM - 7:30 AM	14	7	50%	0	0	Y
9	Cc	Sugar Sands Motel, 20723 Front Beach Rd	16-Aug	7:30 PM	72	0	0%	0	0	N
11	Cc	Edgewater Beach Resort, 11212 Front Beach Rd	16-Aug	11:11 PM	94	94	100%	94	0	Y
12	Cc	Lollye on the Beach Motel, 8507 Surf Dr	18-Aug	11:00 PM	108	108	100%	108	0	Y
13	Cc	House, 22005 Front Beach Rd	14-Aug	10:15 PM - 12:10 AM	104	104	100%	34	0	Y
14	Cc	Largo Mar Condo, 5717 Thomas Dr	15-Aug	10:10 PM - 7:30 AM	79	79	100%	0	0	Y
15	Cc	House, 21208 Front Beach Rd	24-Aug	8:29 PM	107	0	0%	0	0	N
16	Cc	Aqua Resort, 15625 Front Beach Rd	19-Aug	10:30 PM	101	101	100%	101	0	Y
18	Cm	House, 21515 Front Beach Rd	24-Aug	10:10 PM	129	0	0%	0	0	N
19	Cc	En Soleil Condo, 7505 Thomas Dr	28-Aug	9:30 PM	83	6	7%	6	0	Y
21	Cc	Hidden Dunes Condo, 7115 Thomas Dr	25-Aug	8:10 PM - 10:00 PM	70	70	100%	5	0	Y

22	Cc	Chateau Motel, 12525 Front Beach Rd	29-Aug	11:45 PM - ~7 AM	85	50	59%	0	0	Y
23	Cm	House, 18920 Front Beach Rd	29-Aug	12:15 AM - ~7 AM	123	0	0%	0	0	N
30	Cc	Long Beach Resort, 10511 Front Beach Rd	10-Sep	10:26 PM - 8:46 AM	2	2	100%	0	0	N
35	Cm	Pinnacle Port Condo, 23223 Front Beach Rd	9-Sep	11:54 PM to 6:45 AM	114	15	13%	0	0	Y
39	Cm	The Shores Condo, 22519 Front Beach Rd	22-Sep	3:45 AM	147	74	50%	0	0	Y
40	Cc	Surf Club Condo, 8517 Surf Dr	29-Sep	sunset to 9:20 PM	30	28	93%	0	0	Y
41	Cc	Aqua Vista Condo, 17155 Front Beach Rd	30-Sep	nighttime	19	8	42%	0	0	Y
44	Cm	Palazzo Condo, 17281 Front Beach Rd	5-Oct	nighttime	64	51	80%	0	0	Y
45	Cm	Townhouse, 22813 Front Beach Rd	5-Oct	3:10 AM	58	10	17%	8	0	Y
TOTAL					2244	1169	52%	644	0	

* live collected exceeds total emerged from excavation results. Source of error unknown.