

Movement Patterns of Snapping Turtles *Chelydra serpentina* throughout the Tidal Cycle in the Cathance and Muddy Rivers

Lucy Van Hook, Doherty Fellowship
Bowdoin College, Biology Department, Summer Research 2005



Abstract

Female snapping turtles (*Chelydra serpentina*) were observed, captured, measured and marked during the nesting season of June 2005. To further determine how snapping turtles of Merrymeeting Bay move within a freshwater tidal system, radio transmitters were attached to the carapace of six female turtles inhabiting the Cathance and Muddy rivers. The turtles were tracked during the summer to map their movement patterns and monitor activity during tidal fluctuations. The turtles tend to cover more distance when the tidal flats are flooded. At low tide, the turtles bury themselves in the mud or travel in the river channels. Similar to last summer, the turtles did inhabit distinct activity zones in the Muddy and Cathance river systems. Further research and data analysis will determine if the channel movement patterns are related to temperature or water level. Traps were set in the Cathance and Muddy rivers for mark and recapture studies to make general population size assessments as well as capture and measure male snapping turtles in the area. Further data collection and research will occur throughout the year and culminate in an Honors thesis and publication length article.

Introduction:

Merrymeeting Bay is a freshwater tidal ecosystem. The Kennebec and Androscoggin rivers are the main rivers that flow into the bay. As the tide moves up the Kennebec river, the fresh water backs up into the bay, creating a freshwater tide and an unique ecosystem. Most aquatic turtles live in water systems that maintain a steady water level, but the snapping turtles of Merrymeeting Bay must live without water throughout each low tide. This scenario creates several questions. How are the turtles moving as the tide cycles through the bay? How do they deal with desiccation stress? Do they stay in the water channel, or crawl around on the mud flats, and at which tides? How are the turtles moving in relation to air, water and mud temperature? How are the turtles moving within the habitat at night? Are the turtles shifting their activity zones as the seasons progress? With these questions in mind, six female turtles were captured during nesting season. A radio-transmitter was attached to each carapace and each turtle was tracked throughout the summer.

Last summer, it was determined that snapping turtles are moving on the mudflats as the tide fluctuates. During the summer of 2005, similar patterns of movement and habitat use were observed. It is ecologically important to know how snapping turtles move within the tidal ecosystem because the slow to reproduce reptiles are in danger of dwindling numbers because harvest rates are high and reproduction rates are low (Tyning 1997). Also, nest predation often results in 100% mortality, making it harder for fecund adults to replace themselves (Tyning 1997). In June 2002, the Department of Inland Fisheries and Wildlife instated a ban on commercial harvesting of snapping turtles in Maine (Austin 2002).

The status of snapping turtle populations in Maine are unknown because they have not been studied, and they are at the extent of their Northern range (Austin 2002). Therefore, it is important that the turtles of Merrymeeting Bay are observed, studied and understood. It is necessary to know what condition the population is in. To better assess population size and demographics traps were set to conduct mark and recapture studies. The second summer of data collection and further data analysis will develop a better understanding of snapping turtle behavior and nesting success in Merrymeeting Bay. Hopefully, these data will help determine the status of snapping turtle populations in Maine, and help augment turtle conservation efforts.

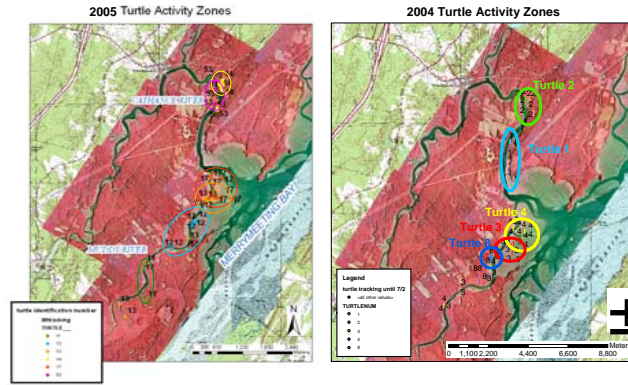


Figure 1. Turtle activity zones on the mudflats and in the channels of the Cathance and Muddy Rivers. During 2005 six female snapping turtles had radio transmitters attached to their carapace and were tracked throughout the designated areas. In the summer of 2004 five turtles, two males and three females, had radio transmitters and were tracked throughout the designated areas. In 2004 the turtles were most frequently found on the mudflats. They moved significantly further distances when the mudflats were flooded. In the summer of 2005, the female turtles were found most frequently in the river channels. Further data analysis is occurring to determine potential reasons for movement within the channel.



Two turtles wrestling in the Muddy River channel



A female nesting in the road side

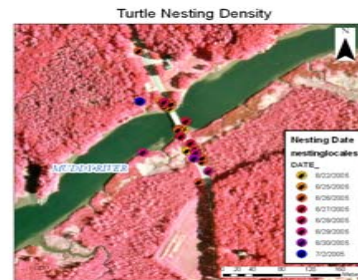


Figure 2. Snapping turtle nesting positions and density along the Muddy River Bridge during the nesting season of 2005 (n=43). Once adequate nesting conditions were reached, female turtles began nesting heavily. Peak nesting ended on June 29, 2005. Only two more female turtles were seen nested after that, though some nested at night and were unseen.

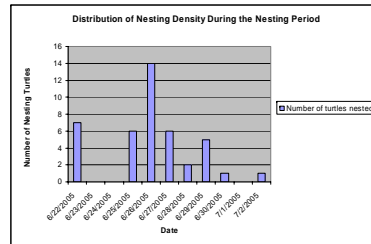


Figure 3. Distribution of captured nesting snapping turtles during the nesting season in 2005 (n=43). All female turtles were captured, measured, weighed and marked. Turtles were not disturbed while laying. June 22, 2005 was the first day nesting turtles were observed. July 2, 2005 was the last day turtles nested. Not all turtles that nested were captured.

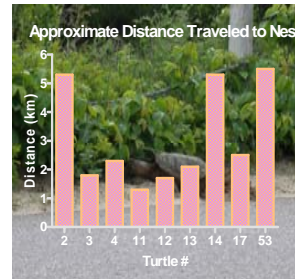


Figure 4. Approximate distances traveled by radio-tagged female snapping turtles from the nesting site to each respective activity zone during 2004 and 2005 (n=9). The turtles traveled up the Muddy River, into Merrymeeting Bay, and up the Cathance River.

Results:

Turtle Basics:

- 54 turtles were captured, measured and marked during the summer in 2004 and 2005.
- Females weighed 4.8 ± 1.3 kg (mean \pm standard deviation, n=49)
- Males weighed 12.3 ± 3.8 kg (n=5)
- Males were significantly larger than females in carapace length, width and depth, as well as plastron length, and weight. (unpaired t-test, $p < 0.0001$, n=49 female, n=5 male).

	Male (mean \pm std dev)	Female (mean \pm std dev)
Carapace Length (cm)	15.6 ± 4.0	28.9 ± 2.9
Carapace Width (cm)	17.2 ± 3.6	27.7 ± 2.6
Carapace Depth (cm)	13.1 ± 2.4	11.1 ± 0.9
Plastron Length (cm)	26.8 ± 3.3	21.1 ± 2.2
Posterior Lobe (cm)	12.4 ± 1.4	10.1 ± 1.1
Posterior Lobe to Vent (cm)	14.5 ± 2.0	7.4 ± 1.2
Plastron Ratio	$1.165 \pm .117$	0.738 ± 0.090

Nesting Females:

- 41 Females were captured, measured and marked during the nesting season between 6-22-2005 and 7-2-2005.
- In comparable sized turtles, females that hadn't laid were not significantly heavier (5.2 ± 1.4 kg, n=26) than females that had laid ($4.6 \pm .9$ kg, n=21) (unpaired t-test, $p=0.08$).
- Females traveled between 1.3 m and 5.5 m to nest at the Muddy River Bridge site.

Turtle Movement:

- Turtles have individual activity zones in specific sections of the Muddy or Cathance Rivers.
- Turtles were typically stationary as the tide receded. Tracks were observed on the mud flats during low tide in the late afternoon. Turtles moved to the channels.
- Turtles were found swimming and moving around more frequently when there was water on the mudflats.
- Based on observations, turtles were found in the channel more frequently this summer when compared to last summer.

Future Goals:

Further Data Collection:

- As the Fall progresses, another 24 hour tracking session will occur.
- The turtles will be tracked to their hibernation locations.
- In September, hatching success rates will be monitored.
- Toxicology assessments of heavy metal accumulation will be determined from deceased hatchlings.
- Further work with recapturing marked turtles to assess population size will occur.
- *Honor's Project.*
- Further data analysis will occur with the movement patterns of the turtles to determine if there is a relationship between movement shifts and air, water and mud temperatures.
- General behavior traits and use of the habitat will also be assessed.

Data to State:

- The raw data that describe the population demographics, such as the size and age of the turtles and the nesting success rate data will be given to the State for future turtle population studies.
- I will also give my thesis on the movement patterns of the snapping turtles of Merrymeeting Bay to the state.

Publication:

- I plan to write a journal length article for publication in an appropriate journal.

Acknowledgements:

I would like to thank Jared Rebin, for directing the research and data collection, John Lichter for advising, Mark Burton, Mary Kate Wheeler and Heather Caron for data collection, Susanne Kynast for literature sources and aging techniques and Anne Henshaw for being the summer fellowship director. My summer's research was made possible by funding from the Doherty Fellowship.

References Cited:

- Austin, Phyllis. "F&W Outlaws Commercial Harvest of Snapping Turtles." *Maine Environmental News*. July 26, 2002.
Brooks, Ronald J. "Dynamics of a Northern Population of Snapping Turtles. How Can a Long Lived Species be Conserved?" *Status and Conservation of Turtles of the Northeastern United States*. Robert Tyning, ed. Massachusetts Audubon Society, 1997.
McCollough, Mark. "Status and Conservation of Turtles in Maine." *Status and Conservation of Turtles of the Northeastern United States*. Robert Tyning, ed. Massachusetts Audubon Society, 1997.

Methods:

Study Area: Snapping Turtles, *Chelydra serpentina*, were captured, marked and released in the Cathance and Muddy Rivers, two smaller tidal rivers that are part of Merrymeeting Bay. Turtles equipped with radio-transmitters were tracked throughout the Cathance and Muddy Rivers.

In the Field:

Measuring Turtles:

- The majority of our marked Snapping Turtles were captured immediately after nesting.
- Females that were no longer nesting, were weighed in kilograms, measured in centimeters using tree calipers, and marked using a file.
- On all captured turtles, male and female, measurements of the maximum length and width of the carapace, the length of the plastron, the plastron posterior lobe, and the distance from the base of the posterior lobe to the vent were taken before the turtles were taken later.
- Turtles were marked with a file, with the marginal scutes labeled 1-5 on the right and 10-50 on the left.

Trapping Turtles:

- Hoop traps were equipped with flotation devices to ensure air pockets as the tide fluctuated. Both ends were anchored to keep the trap open.
- Hoop traps were baited with sandbars and set in smaller tidal creeks of the Cathance and the Muddy Rivers.
- Traps were set for several days, but were checked every 24-25 hours.
- The same measurements were taken on trapped turtles.

Tracking Turtles:

- Radio transmitters were placed on the lower right section of the carapace of six female turtles. All of the female turtles were captured at the Muddy River Bridge during nesting season.
- Radio transmitters were adhered to the carapace with marine epoxy.
- Once the turtles were released, the transmitter radio signals are picked up by the yagi antenna. Using the antenna allows the field researcher to locate the turtle.
- Once the turtle was found data were collected. The data were positional location, air, water and mud temperature, density and type of vegetation, tidal stage, exposure of carapace and any other observations.
- The turtles were tracked 2-4 times weekly during June and July, and at least once a week during August.
- Twenty-four hour tracking sessions occurred on July 12, and August 23, 2005.

Data Logger:

- Continuous air, water and mud temperatures of the mudflat and nearby water channel were obtained via probes that transferred the data to a HOBO Micro Station data logger.
- Light levels were measured with a Photosynthetically Active Radiation (PAR) smart sensor, which also downloaded data to the HOBO Micro Station data logger.

In the Lab:

Data Analysis:

- Tracking, trapping and nesting data were entered into excel worksheets.
- Positional data were transferred to ESRI ArcMap files and displayed visually.
- Movement patterns were analyzed on the maps.
- Further analysis will occur with the temperature data logger data.

Determining the age of a turtle