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

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Abstract:

To determine how the snapping turtles of Merrymeeting Bay use a freshwater tidal systems, radio transmitters were attached to the carapace of five turtles inhabiting the Cathance and Muddy rivers. The turtles were then tracked to discern their movement patterns as the water levels fluctuated in the tidal system. Overall, the turtles seem to move when the tidal flats are flooded, and bury themselves in the mud at low tide. So far, there is no significant difference in movement patterns, or distance traveled between the five tracked turtles, even when separated by sex. However, the turtles did utilize distinct activity zones in the Muddy and Cathance river systems. Further tracking will occur next summer to help determine more explicit movement patterns and habitat use by snapping turtle in Merrymeeting Bay. Research concerning nesting habits, egg laying and hatching dates, nest predation and road mortality rates will be conducted.

Introduction:

Merrymeeting Bay is a freshwater tidal ecosystem formed at the confluence of the Kennebec, Androscoggin, Eastern, Muddy, Cathance, and Abagadasset. As the tide moves up the Kennebec River from the ocean, the freshwater 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 during each low tide. This scenario creates several questions. Do the turtles move as the tide cycles through the bay? If so, how? 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? With these questions in mind, five turtles were captured from the banks of the Cathance and Muddy rivers and equipped with radio transmitters so they could be tracked throughout the tidal cycle.

The Cathance and Muddy rivers are ideal locations for tracking and capturing turtles because large expanses of bare mud are exposed during low tide. The turtles come to bask on the open mud and are easier to capture. The five turtles that had radios attached to their carapaces weighed between 4.8 and 15.0 kg, and measured 27.2 x 24.2 to 37.4 x 32.8 cm. During the summer, the five turtles were tracked throughout the tides to see how they moved within the area.

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 harvesting rates are high and reproduction rates are low (McCollough 1997). Also, nest predation often results in 100% mortality, making it harder for fecund adults to replace themselves (McCollough 1997). In June 2002, the Department of Inland Fisheries and Wildlife instated a ban on commercial harvesting of snapping turtles in Maine (Austin 2002). Little is known about the status of Snapping turtle populations in Maine and even less is know about how snapping turtle use freshwater tidal systems like Merrymeeting Bay (Austin 2002). Eventually, this study will develop a better understanding of snapping turtle populations in Maine, and help augment turtle conservation efforts.

Methods:

Study Area:

- The snapping turtles were tracked within the Cathance and Muddy rivers that adjoin Merrymeeting Bay. The rivers are tidal, so large mud flats are exposed along the banks at low tide. At high tide the vegetated mud flats are submerged below 4-5 feet of water

Capturing Snapping Turtles:

- Most turtles were captured at low tide while basking on the mud flat, or post egg laying.
- The captured turtles were weighed in kilograms.
- The carapace width, length and depth were measured with centimeter calipers.
- Sex was determined by observing the distance of the vent from the posterior marginal scutes.
- If female, the body cavity was searched for eggs. Nesting females were capturing after laying.
- The turtle was marked by filing a notch in the marginal scutes.
- Nearby vegetation was noted.
- The position of the turtle was taken with a handheld GPS.
- Water, air and mud temperatures were taken with a Celsius thermometer.
- The turtle was returned to the position of capture.

Adhering Radios:

- Telemetry radios were adhered to five separate turtles.
- Radios were placed on three females and two males.
- The epoxy putty and radio were adhered to the rear, right of the carapace.
- After the epoxy hardened, the turtles were released at their original position.

Tracking Turtles:

- The five radioed turtles were tracked with a Yagi directional antenna.
- Once found, the position of the turtle was recorded, along with air, water and mud temperature, local vegetation, whether the turtle was seen, and any other observations.
- The turtles were tracked 2-4 times a week throughout a tidal cycle.

In the Lab:

- The turtle data was entered into excel worksheets to be analyzed by Statview 5.0.1.
- A visual map of the positional data was created in ESRI GIS ArcMap.

Distances traveled and activity zones of each turtle were identified on the map.

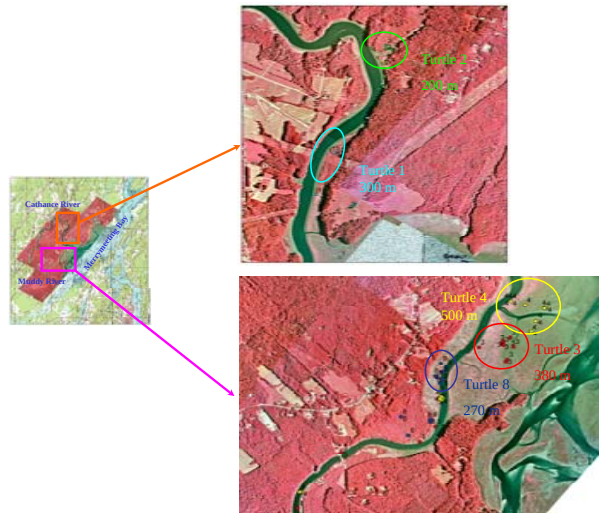

Figure 1. Snapping turtle activity zones within the Cathance (upper image) and Muddy (lower image) rivers. The top of the map represents North. The smaller image is of Merrymeeting Bay, and the Cathance and Muddy Rivers are outlined. Each turtle seemed to stay within an active range, though they moved within it freely. The lone dots for turtle 3 and turtle 4 are from their nesting day. They both nested along side the road at the Muddy River bridge. Further work will be done to assess how much movement occurs outside of the activity areas, or if they shift from year to year.

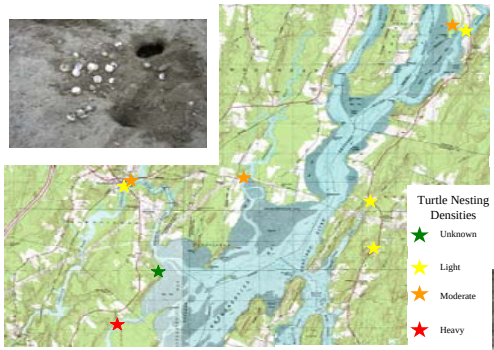

Figure 2. Snapping turtle nesting locations around Merrymeeting Bay. Nesting densities are based on number of nests observed within the nesting location, they are not uniform in area or number of nests observed.

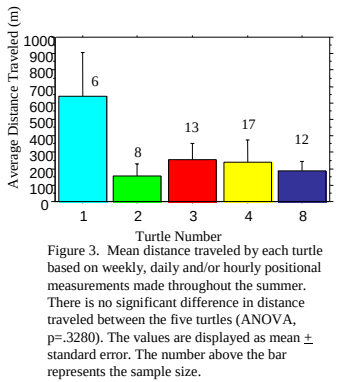

Figure 3. Mean distance traveled by each turtle based on weekly, daily and/or hourly positional measurements made throughout the summer. There is no significant difference in distance traveled between the five turtles (ANOVA, p=.3280). The values are displayed as mean ± standard error. The number above the bar represents the sample size.

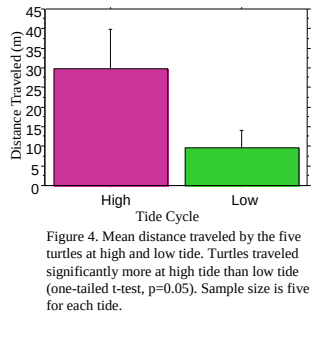

Figure 4. Mean distance traveled by the five turtles at high and low tide. Turtles traveled significantly more at high tide than low tide (one-tailed t-test, p=0.05). Sample size is five for each tide.

RESULTS:

- Each of the radioed snapping turtles had a distinct activity zone where they were most often tracked (Fig. 1). The turtles were observed basking, both above and below the surface of the mud, and swimming and crawling above the mud surface with in the activity zones.
- The turtles were typically stationary as the tide went out.
- The turtles usually started moving around the surface of the mud flat as the tide came in. Sometimes they would stay buried in the mud as water levels rose. By high tide, the turtles were usually moving in the water. The five turtles moved significantly more at high tide than at low tide (Fig. 4, unpaired t-test, p=0.05).
- During low tide in the late afternoon, several uncaptured turtles were seen walking briskly to the river channel. Tail and claw tracks were also left on the mud, indicating movement to the channel. Therefore, it seems as though the turtles must return to the water, or bury in the mud after several hours of exposure to the sun to reduce the risk of desiccation.
- The turtles usually remained on the mud flat and rarely crossed the main Muddy river channel (Fig. 1). Turtle 4 was the only turtle observed that actually crossed the river channel after returning from nesting. Both turtle 3 and 4 crossed the channel to nest (Fig. 1).
- Nests occurred in the sandy soil substrate nearby bridges (Fig. 2).
- Turtle 1 traveled the most in between data collection. Turtle 2 remained in a very small activity zone. Turtle 3 and 4 both had large activity zones on the vegetated mud flat at the mouth of the Muddy River. Turtle 8 stayed in a small activity zone, but took trips to far away places (Fig. 3, Fig. 1).
- There was no significant difference in the distance traveled when the females were compared to the males (unpaired t-test, p=.5048).

Nesting Turtles:

Nesting snapping turtles lay their eggs in soft, slightly damp, sandy soil. Around Merrymeeting Bay, this type of soil is most commonly found along roads, or around bridges. Turtles 3 and 4 in the study traveled 1.7, and 2.2 kilometers respectively to lay their eggs at the Muddy River bridge. It can be assumed that there is no suitable nesting substrate alongside the river before that. However, with nesting sites along roadsides, hatchling mortality increases as cars go speeding past. This presents a problem because turtles are so slow to successfully reproduce. In Maine, snapping turtles reach sexual maturity around 16-20 years (Brooks 1997). A female will lay 20-40 eggs, but all of them rarely hatch. Most nests are preyed upon, resulting in 100% mortality (Brooks 1997). Therefore, for the eggs that do hatch, sometime in mid-September or early October, we intend to monitor road mortality to see if we can increase hatchling survival rates by directing the turtles to the water instead of across the road.

Future Goals:

1. Track the snapping turtles to their hibernation location.
2. Set up turtle traps to capture a larger portion of the population.
   a. See if any juveniles are trapped, since none were seen this year.
   b. Establish age, weight, and size demographics of the adult population and compare them to local non-tidal populations.
3. Monitor and map nesting locations.
   a. Monitor nest predation and mortality.
   b. Monitor hatchling success.
   c. Identify ideal nesting habitat.
   d. Compare nesting locations to winter hibernation locations.
4. Monitor adult and hatchling turtle road mortality.
5. Adhere ten new radios on the same turtles to continue tracking for another year for further assessment of movement patterns.

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