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Incidence of Aural Abscesses in Painted Turtle (*Chrysemys picta*) Populations in Minnesota

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ABSTRACT. – Aural abscess incidence in 22 painted turtle (*Chrysemys picta*) populations in Minnesota averaged 0.7% (range, 0.0%–9.1%) of more than 2700 captured turtles. Results indicate the need for more research regarding incidence and causes of aural infections in turtles and possible directions for future work are suggested.

Aural abscesses in turtles result from opportunistic bacterial infection of the middle ear and appear as large swellings on one or both sides of the head (Fig. 1). Most of the literature regarding aural abscesses in turtles involves box turtles (*Terrapene*), but the condition is known to affect many turtle species (Murray 1996). Several factors are thought to predispose turtles to such infections. In captivity, aural abscesses typically result from improper husbandry, poor nutrition, and keeping animals at suboptimal temperatures. The exact causes in wild turtles are unknown, although aural abscesses in box turtles have been associated with such factors as wet weather (Dodd and Griffey 2004), insect bites and trauma (Dodd 2001), and environmental contamination (Tangredi and Evans 1997; Holladay et al. 2001). This is the first report on the incidence of aural abscesses in wild painted turtle populations in Minnesota.

Methods. — Abscess data were collected from 22 painted turtle (*Chrysemys picta*) populations in central Minnesota. Turtles were captured from May through August 2001 and 2002, May 2003, and August 2004 using basking traps, baited hoop traps, and by hand. Front claw length and position of the cloaca relative to the rear edge of the carapace were used to classify each captured turtle as male or female (Gibbons and Lovich 1990). Turtles with no discernable secondary sex characteristics and a carapace length (CL) $<$ 9–10 cm were considered juveniles (Ernst et al. 1994). Turtles received a permanent, unique identification code drilled into the marginal carapace scutes so they could be identified if recaptured. Every captured turtle that possessed an aural abscess was noted. Contingency table analysis was used to determine if there was a nonrandom association between the presence of an abscess and the type of trap in which a turtle was captured.

Results. — Turtles with abscesses occurred in 9 of the 22 sampled populations. Nineteen out of 2703 painted turtles marked between 2001 and 2004 possessed aural abscesses (0.7 %). The incidence of abscesses varied among the 9 populations that had abscessed turtles from 0.5% to 9.1% (Table 1). All abscessed turtles appeared otherwise healthy and none showed signs of lethargy or other illness. Nine turtles had an abscess on the right side of the head, 8 turtles had one on the left side, and in 2 animals the side was not recorded. All but one of the turtles captured with abscesses were adults. The smallest turtle, a juvenile, had a CL of 94 mm. The remaining turtles had CL ranging from 97 to 168 mm. Two individuals with abscesses were captured multiple times. The first was a male captured 3 times in 2002 in Lake Maria (Wright County). The second was an adult female first captured in 2002 in Beaver Lake (Stearns County) and subsequently recaptured in 2004 with no apparent change in the abscess. Turtles with abscesses were captured in every month trapping was conducted.

Turtles with abscesses were caught in basking traps at a slightly higher rate than in hoop traps, compared to turtles without abscesses. The basking trap/hoop trap catch ratio was 7.7:1 for turtles with abscesses and 4.7:1 for turtles without abscesses, although this difference was not statistically significant (Pearson chi-square contingency table analysis, $\chi^2 = 0.631$ $p = 0.4271$).

Discussion. — The incidence of aural abscesses in painted turtles was variable among populations in central Minnesota. The only other account of abscesses in painted

Figure 1. A male painted turtle with aural abscess on the right side of the head, captured in a basking trap in Lake Maria, Wright County, Minnesota in August 2001.

Table 1. Incidence of aural abscesses in painted turtles captured in central Minnesota lakes from 2001 to 2004.

Lake	County	No. of marked turtles in each lake	No. with abscesses	% with abscesses
Bjorkland	Wright	75	0	0.0
Gemini East	Stearns	43	1	2.3
Gemini West	Stearns	59	1	1.7
Half Moon	Hennepin	71	1	1.4
Henschein	Kandiyohi	112	1	0.9
Lake 21	Kandiyohi	198	0	0.0
Maria	Wright	914	5	0.5
Sagatagan	Stearns	107	0	0.0
Spurzum	Hennepin	143	0	0.0
Stumpf	Stearns	88	0	0.0
Beaver	Stearns	173	3	1.7
Black Oak	Stearns	134	0	0.0
Cedar South	Stearns	27	0	0.0
Cedar North	Todd	40	2	5.0
Guernsey	Todd	57	0	0.0
Goodners	Stearns	50	0	0.0
Little Sauk	Todd	50	0	0.0
Long South	Stearns	123	0	0.0
Long North	Todd	31	0	0.0
Mary	Todd	122	0	0.0
Pelican	Stearns	53	2	3.8
Sylvia	Stearns	33	3	9.1
Total		2703	19	0.7

turtles appears to be Christiansen et al. (2005) reporting 1 abscess in 212 captured turtles (0.47%) along the Mississippi River in Iowa. The prevalence of aural abscesses in other emydid turtle species is quite variable: 26 of 2477 (1.0%) in Florida box turtles (*Terrepene c. bauri*) in Florida (Dodd and Griffey 2004); 5 of 19 (26.3%) in eastern box turtles (*Terrepene c. carolina*) in Virginia (Holladay et al. 2001); 19 of 90 (21.1%) in eastern box turtles in New York (Tangredi and Evans 1997); and 16 of 460 (3.47%) in ornate box turtles (*Terrepene ornata*) in Iowa (Christiansen et al. 2005). The prevalence of abscesses in Minnesotan painted turtle populations was within the range of published accounts, although some populations have much higher rates than others, such as Lake Sylvia in Stearns County, where 9.1% of 33 captured turtles possessed abscesses.

Turtles bioaccumulate several pollutants (Helwig and Hora 1983), and organochlorine compounds have been implicated in the occurrence of aural abscesses in box turtles (Tangredi and Evans 1997; Holladay et al. 2001). Organochlorine compounds are thought to interfere with vitamin A metabolism, a shortage of which can predispose turtles to aural abscesses (Murray 1996; Brown et al. 2004). Because the link between abscesses and organochlorine compounds is far from conclusive (Willer at al. 2003), it is important to identify average abscess rates in wild turtle populations so that findings on contaminants can be put into proper context. Knowledge of the average rate of aural abscesses in turtles will allow researchers to identify populations with unusually high abscess rates that may require further investigation. Populations like the one in Lake Sylvia in this study would be a candidate for such further investigation, which would involve submitting turtle liver biopsies and water samples for organochlorine analyses.

Painted turtles increase body temperature in response to bacterial infection (Monagas and Gatten 1983). Because basking is an important means of thermoregulation, one would expect more frequent or longer basking in turtles with abscesses compared with healthy turtles. Frequent basking would make turtles more likely to be captured in basking traps as compared to hoop traps. The failure to find significant differences in capture rates of turtles with abscesses in basking traps compared to turtles without abscesses is surprising given the different behaviors that influence the efficiency of each trap style. However, it is possible that turtles with abscesses bask for longer periods of time rather than more frequently, which would not be reflected in increased capture rates. Further work is needed to determine how painted turtles alter behavioral or basking patterns in response to bacterial infection.

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Northern Diamondback Terrapin Occurrence, Movement, and Nesting Activity Along a Salt Marsh Access Road

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ABSTRACT. – Northern diamondback terrapins, *Malaclemys terrapin terrapin*, were tagged with passive integrated transponder tags to mark them and monitor their activity along a road through salt marsh habitat in Tuckerton, New Jersey. A mark-recapture study was conducted to evaluate terrapin movements, nesting frequency, and nest site fidelity. During sampling periods throughout 2 nesting seasons (2004–2005), 300 adult females were tagged. Ninety-two recaptures were made of 54 individual terrapins, with most recaptures (81.5%) occurring within a season (range = 1–45 days, mean = 7.5 days). Some recaptures (18.5%) occurred the following year. Some females crossed the road multiple times during nesting, and nearly half searched for a site within 50 m of the area where they were initially tagged. Nest site selections of all multiple nesters (within and among seasons) varied greatly from approximately 4–1307 m (mean internesting distance = 202.75 m), yet 39% were recaptured within 50 m of their initial tagging location. One-third of yearly nesters showed an internesting distance within 25 m of their initial-year tagging location. These results indicate that some females travel variable distances between nest sites and may demonstrate evidence of nest site fidelity.

As aquatic and upland habitats are developed, modified, or fragmented by human activities (e.g., roads), reproduction of turtles may be increasingly affected as they need to make movements of variable distances overland to find suitable nesting habitat, which may be natural or altered by humans. Nesting females may be attracted to human disturbed sites where little vegetation is present and the ground is open to direct sunlight. These sites can be near houses and fences (Kolbe and Janzen 2002), human-made trails (Feinberg and Burke 2003), edges of power-line rights of way and forest clearcuts (Litzgus and Mousseau 2004), and mowed shoulders of roads (Aresco 2005). Turtles cross roads in agricultural (Reese and Welsh 1997) and residential (Steen and Gibbs 2004) areas and nest along roads near wetland and beach habitat (Seigel 1980a; Wood and Herlands 1997; Standing et al. 1999; Haxton 2000; Joyal et al. 2001; Hoden and Able 2003; Rowe et al. 2005; Szerlag and McRobert 2006). Some aquatic turtles travel great distances through terrestrial landscapes and across roads to nest in fragmented nesting habitat when suitable habitat is limited (Baldwin et al. 2004). Many aquatic turtles, including diamondback terrapins, prefer to nest in areas of sandier soils, little vegetation, and higher elevation (Burger and Montevecchi 1975; Butler et al. 2004). Because marsh roadsides may provide the habitat conditions that are suitable for nesting, substantial turtle mortality also results