Marking Nests Increases the Frequency of Nest Depredation in a Northern Population of Painted Turtles (Chrysemys picta)

Author(s): Njal Rollinson and Ronald J. Brooks

Source: *Journal of Herpetology*, Mar., 2007, Vol. 41, No. 1 (Mar., 2007), pp. 174-176

Published by: Society for the Study of Amphibians and Reptiles

Stable URL: https://www.jstor.org/stable/4498569

Marking Nests Increases the Frequency of Nest Depredation in a Northern Population of Painted Turtles (*Chrysemys picta*)

NJAL ROLLINSON[1] AND RONALD J. BROOKS[2]

Department of Integrative Biology, University of Guelph, Guelph, Ontario, N1G 2W1 Canada

ABSTRACT.—Predators use visual and olfactory cues to locate turtle nests. Since 1999, we marked Painted Turtle (*Chrysemys picta*) nests at a long-term study site by inserting Popsicle™ sticks part way into the nest cavity. Because nest-marking provides a cue to potential predators, we tested whether nest-marking increases nest depredation rates. During the nesting season, 15 artificial nest pairs ($N = 30$ artificial nests in total) were created by digging and refilling holes (presumably emulating nest excavation by turtles) at a nesting site. Nests in each pair were 45 cm apart, but only one nest in each pair was marked with a Popsicle™ stick, and no eggs were placed in either hole. After one week, depredation was observed in nine of the 15 nest pairs, and all depredation events were directed towards marked nests. A Binomial Test revealed that this pattern was significantly nonrandom. It is possible that predators were responding to olfactory cues left by Popsicle™ sticks, and given that mammalian predators are common at our study site, we cannot rule out the possibility that such olfactory-oriented predators depredated artificial nests. However, we suspect that Common Ravens (*Corvus corax*) and American Crows (*Corvus brachyrhynchos*; nest predators that are visually oriented) were the primary predators in this study. Future experiments should use turtle eggs in both marked and unmarked nests to evaluate whether the markers represent a significant mortality factor for Painted Turtle eggs.

Rates of nest depredation are generally high in chelonians, but these rates clearly vary both spatially and temporally within populations (Tinkle et al., 1981; Hamilton et al., 2002; Bowen and Janzen, 2005; Burke et al., 2005). Predators presumably rely on visual and olfactory cues to locate nests, and the relative importance of either cue depends on the predator species and ambient conditions (e.g., light) at the time of foraging. Many studies have investigated the relative importance of these cues (e.g., Hamilton et al., 2002; Spencer, 2002; Bowen and Janzen, 2005; Burke et al., 2005), but no general (predictive) trend is apparent across all studies.

Nest-marking is often used in both short-term and long-term monitoring programs because it ensures the timely and proper identification of individual nests at a later date. Some studies have shown that this practice is not associated with increases in nest depredation (e.g., Hamilton et al., 2002; Burke et al., 2005) and that anthropogenic disturbance of the nest can even decrease nest depredation (Burke et al., 2005). However, other studies have shown that nest-marking can increase the probability of nest depredation through visual cues (Mroziak et al., 2000). This latter possibility is disconcerting because it suggests that nest-marking can result both in inaccurate estimates of actual nest depredation rates and offspring mortality rates.

We have been intensively studying a population of Painted Turtles (*Chrysemys picta*) in Algonquin Provincial Park since 1990. Beginning in 1999, we marked turtle nests by inserting a Popsicle™ stick (labeled with turtle ID, number of eggs, and the nest date) part-way into the nest cavity. This provided a convenient, inexpensive, and relatively inconspicuous (e.g.,

as opposed to flags) nest-marker. However, because we are providing a cue to potential nest predators, we tested whether nest-marking is associated with an increase in the rate of nest depredation.

MATERIALS AND METHODS

West Rose Lake (WRL) is one of two major ponds in which the majority of females in the study population reside. WRL is a black spruce (*Picea mariana*) bog that is mostly 1.3 m deep and is bisected into an east and west side by a 5 m high, 750 m long abandoned railway embankment where most or all resident females nest during the nesting season. The embankment is also part of a popular hiking trail, and during the nesting season, we estimate that approximately 20–30 groups of tourists pass along the embankment daily. There are many open sandy areas on the embankment where females can nest. Mosaics of tamarack (*Larix laricina*), white pine (*Pinus strobus*), and leather-leaf (*Chamaedaphne* sp.) pervade other areas of the embankment, and these areas do not appear to be suitable for nesting (Hughes, 2003).

Since 1999, we have been marking nests by inserting a Popsicle™ stick into the nest cavity so that about half of the stick (~5–7 cm) protrudes from the cavity. Popsicle™ sticks are purchased in bulk, and they are not artificially colored. We used artificial nests to test whether nest-marking influences rates of depredation. On 28 June 2006 (toward the end of the nesting season), we chose 15 equidistant locations along the WRL embankment (spaced ~50 m apart) that were sandy and that appeared to be suitable nesting sites (Hughes, 2003). At each location, we dug two holes (depth = 10 cm) that were 45 cm apart. The holes were then filled with the sand that was originally contained therein, and we haphazardly selected one hole to be marked with a Popsicle™ stick, and the other was marked with small pebbles. We inscribed the replicate number on each Popsicle™ stick using

---
[1] Corresponding Author. E-mail: nrollins@uoguelph.ca
[2] E-mail: rjbrooks@uoguelph.ca

a black Sharpie™; this emulates the manner in which Popsicle™ sticks are marked for use in real turtle nests. On 4 July 2006, we visited each artificial nest and recorded depredation events. Artificial nests were considered depredated if they had been dug up.

RESULTS

No unmarked nests were depredated, but 60% of marked nests (nine of 15) were depredated. We cannot assume that nest pairs in which neither nest was depredated were actually visited by predators; hence, these nest pairs were omitted from the analysis. We used a simple Binomial Test (Zar, 1984) on the nine remaining nest pairs to determine whether the depredation pattern was nonrandom. With an expectation that both marked and unmarked nests would have been depredated equally when visited by predators, the observed depredation pattern was significantly non-random ($P = 0.002$).

DISCUSSION

The WRL embankment is part of a popular hiking trail; hence, it is possible that tourists dug up most of the marked nests. However, we deem this unlikely. There was no obvious evidence of direct anthropogenic disturbance at any of the depredated nests, and despite our regular presence in the early morning and late afternoon/evening hours at the site, we have never observed tourists digging up nests since we started using the Popsicle™ sticks in 1999.

This experiment, although simple in design, lends reasonable evidence to the hypothesis that, in our study population, nest-marking provides predators with a cue that can increase the likelihood of nest depredation. Although we assume that Popsicle™ sticks are primarily a visual cue, we marked Popsicle™ sticks with Sharpies™, and the Popsicle™ sticks may have had an odor of their own. Moreover, Popsicle™ sticks were handled by researchers; hence, we cannot rule out the possibility that the nest predator(s) were responding to olfactory cues.

Our findings are contrary to those of Burke et al. (2005) who reported that using conspicuous flags to mark artificial turtle nests (*Malaclemys terrapin*) did not increase nest depredation by Raccoons (*Protocyon lotor*). This could reflect predator differences among the two study sites, where the predator(s) may have been visually oriented in our study (assuming Popsicle™ sticks are primarily a visual cue) and olfactory-oriented in the study of Burke et al. (2005). Indeed, it is likely that the degree of predictability between nest-marking and nest depredation depends on the type of cue provided (i.e., visual, olfactory, or both) coupled with the abundance and search pattern of the potential predator(s) (i.e., visually or olfactory-oriented).

In both the present study and in that performed by Burke et al. (2005), artificial nests did not contain turtle eggs. Because turtle eggs are likely an important cue for olfactory-oriented predators, it is possible that no difference in depredation rates would be observed if both control nests and marked nests contained eggs. However, Spencer (2002) manipulated olfactory cues and level of disturbance (visual cues) to test their relative effects on nest-depredation rates. He found that artificial nests that were both disturbed by researchers and that contained turtle eggs (*Emydura macquarii*) were most likely to be depredated (by Red Foxes, *Vulpes vulpes*). Nests that contained eggs and where disturbance was minimal were not, however, depredated more than nests that did not contain eggs and that were more thoroughly disturbed. Moreover, Hamilton et al. (2002) did not detect a difference in depredation rates among artificial turtle nests (*Trachemys scripta*) where either visual or olfactory cues were provided to predators, though depredation in both treatments was high ($> 75\%$). Perhaps the most reasonable conclusion we can draw is that both visual and olfactory cues can be important predictors of depredation and that the presence of either cue can increase depredation rates.

Because nests were revisited only after one week had elapsed, and because animal tracks left in the sand are often disturbed by tourists and by weather-related phenomena (rain, heavy winds), we were not able to identify the predator(s) in our study. However, in 2006, we observed three instances of nest depredation by Common Ravens (*Corvus corax*) and American Crows (*Corvus brachyrhynchos*) at our study site. Furthermore, in another study area where there are far fewer nests laid, we observed that birds (inferred from footprints around the depredated nests) had removed Popsicle™ sticks from both Painted Turtle (one instance) and Common Snapping Turtle (*Chelydra serpentina*) nests (three instances). In the former case, the Painted Turtle eggs were eaten, but apparently, the avian predator could not dig deep enough to expose and prey on the Snapping Turtle eggs (also see Burger, 1977). It is possible that Ravens and Crows were primarily responsible for nest depredation in our study, and that the Popsicle™ sticks provided a visual cue to these visually oriented predators (Harriman and Berger, 1986; Sugden and Beyersbergen, 1986; Sebastian et al., 2002). However, olfactory cues were also different among marked and unmarked nests in our study; thus, we cannot be certain that the cue was visual. Nor can we rule out the possibility that mammalian predators (Red Foxes, Striped Skunks [*Mephitis mephitis*], Raccoons) depredated the artificial nests, as mammalian depredation of turtle nests is common at our study site, and these predators can presumably use both visual and olfactory cues when searching for nests. It is, however, of interest that mammalian predators rarely dig up abandoned nest cavities (cavities that were excavated by turtles but that were abandoned before any eggs were laid) that have been filled with sand by researchers (R. J. Brooks, pers. obs.).

Samson et al. (in press) found that the removal, measurement, and reburial of turtle eggs at our study site did not affect hatching success. They also used Popsicle™ sticks to mark nests, but in their experiment, wire cages were placed below the surface of the sand to protect nests from potential predators, and there was evidence of attempted nest depredation by mammalian predators (E. J. Hughes, pers. comm.). Given that nest-marking is associated with an increase in artificial nest depredation, we cannot reasonably conclude that researcher interference has no effect on offspring survivorship in our study population. Further research is needed to test whether this bias in depredation persists when both control

nests and marked nests contain turtle eggs, but our study should nonetheless serve as a cautionary note for researchers engaging in similar monitoring programs.

LITERATURE CITED

BOWEN, K. D., AND F. J. JANZEN. 2005. Rainfall and depredation of nests of the Painted Turtle, *Chrysmys picta*. Journal of Herpetology 39:649–652.

BURKE, R. L., C. M. SCHNEIDER, AND M. T. DOLINGER. 2005. Cues used by racoons to find turtle nests: effects of flags, human scent, and Diamond-Backed Terrapin sign. Journal of Herpetology 39:312–315.

BURGER, J. 1977. Determinants of hatching success in Diamondback Terrapin, *Malaclemys terrapin*. American Midland Naturalist 97:444–464.

HAMILTON, A. M., A. H. FREEDMAN, AND R. FRANZ. 2002. Effects of deer feeders, habitat and sensory cues on predation rates on artificial turtle nests. American Midland Naturalist 147:123–134.

HARRIMAN, A. E., AND R. H. BERGER. 1986. Olfactory acuity in the common raven (*Corvus corax*). Physiology and Behavior 36:257–262.

HUGHES, E. J. 2003. Nest-Site Selection, Hatching Success and Hatchling Over-Winter Success in Painted Turtles (*Chrysemys picta*). Unpubl. master's thesis, University of Guelph, Guelph, Ontario, Canada.

MROZIAK, M. L., M. SALMON, AND K. RUSENKO. 2000. Do wire cages protect sea turtles from foot traffic and mammalian predators? Chelonian Conservation Biology 3:639–698.

SAMSON, J., E. J. HUGHES, AND R. J. BROOKS. In Press. Excavation is a nondeleterious method for obtaining fecundity and morphometric data from small-sized eggs of freshwater turtle. Chelonian Conservation Biology.

SEBASTIAN, L., K. E. SIEVING, AND M. L. AVERY. 2002. Use of sensory cues by fish crows *Corvus ossifragus* preying on artificial bird nests. Journal of Avian Biology 33:245–252.

SPENCER, R. J. 2002. Experimentally testing nest-site selection: fitness trade-offs and predation risk in turtles. Ecology 83:2136–2144.

SUGDEN, L. G., AND G. W. BEYERSBERGEN. 1986. Effect of density and concealment on American crow predation of simulated duck nests. Journal of Wildlife Management 50:9–14.

TINKLE, D. W., J. D. CONGDON, AND P. C. ROSEN. 1981. Nesting frequency and success: implications for the demography of painted turtles. Ecology 62:1426–1432.

ZAR, J. H. 1984. Biostatistical Analysis. Prentice-Hall, Inc., Englewood Cliffs, NJ.