et al. (2000. Chelon. Conserv. Biol. 3:569–579) found 19.5% of *E. blandingii* nests in Michigan, USA, failed to produce any hatchlings, and limited or no embryonic development accounted for 16.5% of total nest failures among nests surviving predation. Upon emergence, hatchlings are prey for numerous predators (Ernst and Lovich 2009, *op. cit.*). Here we report on clutch fertility and survival of head-started hatchling *E. blandingii* during the course of a radio-telemetry study in Linn County, Iowa, USA.

In June 2013, seven radio-tagged adult female *E. blandingii* were captured and retained for oviposition induction, based on palpation confirming some were carrying eggs. Radiography confirmed three of the seven females were gravid, and oxytocin was administered to induce egg laying. All eggs were laid within 24 h of oxytocin injection, and the females were returned to their point of capture the day following egg-laying. Three clutches were laid totaling 33 eggs (9, 11, and 13 eggs respectively). Eggs were placed into one of two incubators set to 26.7 and 30°C, respectively. Each clutch was divided between the two incubators to increase hatching success in the event of incubator failure. Eggs from each female were kept separate in individual containers in each incubator. Eggs and incubators were monitored two to three times per week to avoid desiccation, heater failure, and molding.

Only five of 33 eggs successfully hatched. Two additional eggs were fertile (i.e., contained a nearly fully developed embryo), but did not survive to full term. The remaining 26 eggs showed no signs of fertility (e.g., veining, egg chalking, development, etc.). Individual fertility rates among the three females were 0%, 18.2%, and 55.6%. The low fertility rates could have been a result of artificial incubation; however, some eggs were viable and eggs in both incubators successfully hatched, suggesting that incubation was not a factor. Low fertility rates may also be the result of demographic issues within the population. As of June 2013, only eight adult females had been captured at the study site, and only one male, estimated to be ca. 12 years old at the time, had been captured. Based on literature reports, the male may have been too young at the time to be sexually mature (Ernst and Lovich 2009, *op. cit.*). *Emydoidea blandingii* females have the ability to store sperm (Harding and Davis 1999. Herpetol. Rev. 30:225–226) and it is possible that the three females in this study may have retained sperm from males that died before 2013, or that undetected males were present, although annual trapping and radio-telemetry monitoring of the population through 2017 failed to produce additional males.

The five hatchlings were kept over the winter and head-started for release in spring 2014. By May 2014, the juveniles weighed ca. 150 g, were in good health, and were deemed ready for release. Prior to release, each head-started individual was fitted with a radio transmitter (Holohil PD-2, 3.6 g). The juvenile turtles were released in late May 2014 into the wetland the adult *E. blandingii* at the site use as summer habitat and were tracked every two to three days thereafter. Radio-tracking revealed all five juveniles were predated within two weeks of release.

The area in which this population of *E. blandingii* is found has been subject to increasing pressure from urban development over the last 45 y, and as a result, no natural wetlands remain in the area and the wetlands that do exist are completely surrounded by urban development. The population was first recorded in 2002 by TJV and monitored from 2002–2004 using aquatic trapping, drift fences, and radio-telemetry. Although only 13 individuals were captured at that time, a mix of hatchlings, juveniles, and young and old adults were found. In addition, both sexes were well represented. Monitoring of the population occurred again from 2012–2017 and found no evidence of successful recruitment despite surveys specifically designed to target the capture of newly emerged hatchlings and young adults. This population illustrates the multiple threats faced by many small populations, including habitat loss, predation, and a biased sex ratio, which cumulatively can be devasting even to long-lived species.

We thank the Iowa Department of Natural Resources Wildlife Diversity Program for funding the study under the Wildlife Diversity Small Grant Program; Molly Stephenson, Stacey Parks, and Sarah VanDeWalle for assisting with the care of the hatchling turtles; Doug Peterschmidt for volunteering veterinary services and providing the necessary facilities and equipment for X-raying turtles and administering oxytocin; and Ryan Rasmussen and Luke Hodges for assistance with radio-tracking. All turtles were collected and handled under an Iowa Scientific Collector's Permit (SC388).

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***EMYDOIDEA BLANDINGII* (Blanding's Turtle). TERRESTRIAL ESTIVATION.** *Emydoidea blandingii* is a semi-aquatic emydid turtle. The habitat use of this species changes seasonally, with individuals typically visiting multiple wetlands throughout a year and sometimes making long distance terrestrial movements between wetlands (Ernst and Lovich 2009. Turtles of the United States and Canada. Second Edition. The Johns Hopkins University Press, Baltimore, Maryland. 827 pp.). In addition, deteriorating wetland health caused by decreasing water levels (i.e., drought) may influence turtle movements and behaviors. When subjected to decreasing water levels in wetlands, turtles may respond by moving to other wetlands or remaining in less desirable habitat and estivating until water returns (Roe and George 2008. Ecology 89:485–494).

Terrestrial estivation—defined here as a period of terrestrial inactivity or dormancy that coincides with increased temperatures or decreasing water availability in the local habitat—has been documented in some populations of *E. blandingii* (e.g., Ross and Anderson 1990. J. Herpetol. 24:6–12; Joyal et al. 2001. Conserv. Biol. 15:1755–1762). Although many studies on *E. blandingii* home range and habitat use have been completed throughout its range (e.g., Ross and Anderson 1990, *op. cit.*; Joyal et al. 2001, *op. cit.*; Beaudry et al. 2009. J. Herpetol. 43:636–645; Edge et al. 2010. Ecoscience 17:90–99), only a few have reported estivation behavior (Ross and Anderson 1990, *op. cit.*; Rowe and Moll 1991. J. Herpetol. 25:178–185; Joyal et al. 2001, *op. cit.*), ranging from 6 h to 5 d. Despite these studies, there is little direct evidence supporting the hypothesis that *E. blandingii* engages in terrestrial estivation in response to drought conditions. Furthermore, limited published data exist regarding the details of specific *E. blandingii* estivation behavior, including length of time, canopy coverage, and distance from wetlands. The following observations were made in the course of conducting a radio-telemetry study of *E. blandingii* in Linn County, Iowa, USA.

During 2012, six female *E. blandingii* were captured and fitted with temperature-sensitive radio-transmitters (HOLOHIL Systems LTD Model A1-2F [24 g]) and released at the point of capture. Turtles were relocated via radio-telemetry three times per

week in June, July, and early August and every other day from mid-August until they entered hibernation. All radio-tracked locations were plotted using ArcGIS and distances to terrestrial estivation locations were measured as the minimum straight-line distance from the nearest wetland edge to the estivation site. A 0.5 m^2 frame was centered at each estivation location to visually estimate canopy coverage.

All six radio-tracked *E. blandingii* estivated terrestrially in upland habitats. Five of the six went into estivation between 8 and 23 August 2012 and remained in that state until 31 August to 24 September 2012. After leaving their estivation sites, the turtles moved to a nearby constructed pond where they hibernated during the winter of 2012/2013. The sixth individual estivated for only seven total days in late June and early July, after which, she traveled 0.8 km east of the study site through a residential area and across several roads to a small perennial stream where she remained the remainder of the summer and through the winter of 2012/2013. On average, turtles estivated 24.7 d or 28.4% of the time during active tracking. The duration of estivation ranged from 7–43 d.

Estivation sites were located in a variety of habitats with canopy coverage ranging from 0–95%. Turtles were found either almost entirely buried in native sand prairie, partially buried in woodland leaf litter and/or pine needles, or completely exposed under shrubs or trees. Estivation sites ranged from 2–78 m (mean = 57.8 m) minimum straight-line distance from the nearest wetland. The number of different estivation locations used by individuals ranged from one to three, with one female using one, four using two, and one using three separate locations. Movement between locations ranged from 1–17 m. One individual returned to a constructed pond for five days between estivation locations, and another remained in the same location during its entire 39-day estivation period. While at the estivation site, some individuals were observed to be alert with their necks fully extended and looking around, while others were motionless with head and limbs pulled inside the shell.

It is believed that the *E. blandingii* in this study exhibited terrestrial estivation in response to extended drought conditions and possible over-crowding. Linn County, Iowa received 60.3 cm of precipitation in 2012 (https://mesonet.agron.iastate.edu/rainfall/; 19 Sept 2022) compared to an annual average precipitation of 95.5 cm (https://www.usclimatedata.com/climate/cedar-rapids/iowa/united-states/usia0138; 19 Sept 2022), and the late summer of 2012 was particularly hot and dry. The area in which this population of *E. blandingii* is found has been subject to increasing pressure from urban development over the last 45 y. As a result, no natural wetlands remain in the area and the only wetland where water of sufficient depth remained in late summer 2012 was a small, constructed pond located in a residential yard. In addition to *E. blandingii*, more than 100 *Chrysemys picta* and *Chelydra serpentina* were captured in the 0.063-ha pond in August 2012. To our knowledge, this is the first documented instance of *E. blandingii* terrestrial estivation in Iowa. These observations illustrate the need to preserve critical habitat components and the ability of some individuals to use less than optimum habitat at times.

We thank the Iowa Department of Transportation for providing funding for the study, and Ryan Rasmussen and Luke Hodges for assistance with radio-tracking. All turtles were collected and handled under an Iowa Scientific Collector's Permit (SC388).

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***GLYPTEMYS INSCULPTA* (Wood Turtle). LONG DISTANCE MOVEMENT.** *Glyptemys insculpta* is known to show strong site fidelity based on recapture data and have impressive homing abilities following deliberate translocation events (Harding and Bloomer 1979. Bull. New York Herpetol. Soc. 15:9–26). The species is unusual in its life history as individuals travel between distinct aquatic overwintering and terrestrial foraging habitats, with males tending to move greater distances up and downstream and females moving further into upland habitats (Compton et al. 2002. Ecology 83:833–843). We report here on an extreme example of the less typical pattern of long-distance movement in a male *G. insculpta*.

As part of an ongoing *G. insculpta* monitoring study, we affixed VHF transmitters on a subset of individuals in a Maine, USA, population. On 25 May 2020, we first located and marked a large adult male *G. insculpta* (220 mm straight-line carapace length, 1450 g; #7273; Fig. 1A) by filing V-shaped notches into the marginal scutes (following Cagle 1939. Copeia 1939:170–173) and affixed a transmitter to the hind left quarter of the carapace. Examination of annuli showed that this male was too old to accurately age (Harding and Bloomer 1979, *op. cit.*). He was determined to be in overall good body condition.

The following field season on 6 August 2021 a colleague notified us of a radio-tagged turtle in his neighbor's yard accompanied by photographs (Fig. 1B). Using unique carapace patterns visible on the photograph, we were able to positively identify the animal as the one marked the previous year. The turtle's identity and general location was confirmed ca. one week later by radiotelemetry, despite being unable to make visual or physical contact at that time. Remarkably, the 2021 location was 29.6 km (straight-line distance) northeasterly from where he was initially found in 2020. After mapping the possible aquatic routes between these two locations, we determined the most likely route is ca. 53 km stream distance (estimated using Google Earth) with two overland stretches of 0.8 km and 1.0 km. All other routes were even longer and more convoluted.

We were again notified by someone unconnected to our project of a radio-tagged turtle in a nearby yard on 21 July 2022, again accompanied by a photograph. We were able to discern a partial notch code from the photograph (Fig. 1C) and this, along with unique carapace patterns and the presence of a transmitter, allowed us to confirm the animal's identity. A VHF signal was not detected, however, likely because of limited transmission range and the elapsed time between the sighting and our visit. The 2022 location lies an additional 6.1 km (straight-line distance) northeasterly from the 2021 location. A likely aquatic route is ca. 10 km stream distance with two overland stretches of 0.8 km and 0.4 km. The total straight-line distance between the initial 2020 capture location and the confirmed 2022 location is 34.8 km, making this the longest movement ever recorded for *G. insculpta* of which we are aware.

Although male *G. insculpta* typically move in the range of 480–1500 m distances up and downstream (Willey et al. 2021. *In* Jones and Willey [eds.], Biology and Conservation of the Wood Turtle, pp. 113–136. Northeast Association of Fish and Wildlife Agencies, Inc., Petersburgh, New York) there are noteworthy exceptions of males moving considerably greater distances. For example, Jones and Willey (2020. Herpetol. Rev. 51:208–211) recorded an adult